MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

VOL. XXIV. NOVEMBER, 1896. No. 11

INTRODUCTION.

The REVIEW for November, 1896, is based on 2,738 reports from stations occupied by regular and voluntary observers, classified as follows: 137 from Weather Bureau stations; 33 from U. S. Army post surgeons; 2,425 from voluntary observers; 33 from Canadian stations; 1 from Hawaii; 96 received through the Southern Pacific Railway Company; 14 from U. S. Life-Saving stations. International simultaneous observations are received from a few stations and used together with trustworthy newspaper extracts and special reports.

The WEATHER REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe. Unless otherwise specifically noted, the text is written by the Editor, but the statistical tables are furnished by Mr. A. J. Henry, Chief of the Division of Records and Meteorological Data. Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada, Mr. Curtis J. Lyons, Meteorologist to the Government Survey, Honolulu, and Dr. Mariano Bárcena, Director of the Central Meteorological Observatory of Mexico.

CLIMATOLOGY OF THE MONTH.

GENERAL CHARACTERISTICS.

The most important storms of November were those of the 5th and the 2d–6th in the Lake Region. The remarkable feature of the month was the area of low temperature and high pressure that prevailed from the western Canadian Provinces southward to the Mississippi and Missouri valleys, as well as the corresponding area of high temperature that prevailed in the Atlantic States. The mean temperature was the lowest on record at many stations in the former region as well as in Oregon and was the highest on record at most stations in the latter region. Equally remarkable was the heavy rainfall in the watershed of the Ohio River and on the coasts of Washington and Oregon. An unusual quantity of snow fell over the Rocky Mountain Region and the northern Slope and eastward to Manitoba and the upper Lakes, leaving an unusually thick layer of snow on the ground at the end of the month. Remarkable floods occurred in the Willamette, due to melting snow; remarkable gorges in the Chippewa and upper Mississippi rivers due to the freezing up of booms of logs; unusually good stages of water for navigation prevailed in the Ohio River. In British Columbia the cold and wind and heavy snow were unprecedented. The cold wave of the 26–30th was preceded by a furious wind with snow in Manitoba on the 25th.

ATMOSPHERIC PRESSURE.

[In inches and hundredths.]

The distribution of mean atmospheric pressure reduced to sea level, as shown by mercurial barometers, not reduced to standard gravity, and as determined from observations taken daily at 8 a. m. and 8 p. m. (seventy-fifth meridian time), is shown by isobars on Chart IV. That portion of the reduction to standard gravity that depends on latitude is shown by the numbers printed on the right-hand border.

The *mean pressures* during the current month were high in the region over and east of the Rocky Mountains, as also over and east of the Atlantic Coast States. Areas of low pressure prevailed from Oregon westward, from Arizona southward, and over the eastern portion of Lake Superior.

The highest pressures were: In Canada, Edmonton, 30.36; Battleford, 30.35; Banff, 30.29; in the United States, Havre and Bismarck, 30.27; Lynchburg, Norfolk, Raleigh, and Wilmington, 30.26; Helena, Williston, Charleston, and Hatteras, 30.25.

The lowest were: In Canada, Esquimault, 29.97; St. Johns, N. F., 30.03; in the United States, Tatoosh Island, 29.95; Fort Canby and Phœnix, 29.96; Yuma, 29.97.

As compared with the normal for November, the mean pressure was in excess over the entire country east of the Rocky Mountains except the valley of the Rio Grande. It was deficient over the Plateau Region and Pacific Coast. The greatest excesses were: at Canadian stations, Edmonton, 0.38; Qu'Appelle, 0.23; Calgary and Swift Current, 0.22; Bermuda, 0.21; in the United States, Bismarck and Eastport, 0.19; Havre, 0.18. The greatest deficits were: Roseburg and Fort Canby, 0.09.

As compared with the preceding month of October, the pressures reduced to sea level show a rise everywhere except in western Oregon, the center of the upper Lake Region, and Newfoundland. The greatest rises were: Edmonton, 0.35; Battleford, 0.33; Calgary, 0.28; Prince Albert, 0.26; Swift Current and Havre, 0.25. The greatest falls were: Tatoosh Island, 0.07; Fort Canby and Esquimault, 0.05.

AREAS OF HIGH AND LOW PRESSURE.

By Prof. H. A. HAZEN.

During November five high areas and eight lows were sufficiently defined to be mapped (see Charts Nos. II and I). The principal characteristics relating to the origin and motion of

these highs and lows will be found in the accompanying table:

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	*	35	90	5, a. m.	45	60	2,140	5.0	428	17.9
II	5, p. m.	52	117	11, p. m.	46	57	4,090	6.0	681	28.4
III	10, a. m.	52	109	16, p. m.	33	79	3,380	6.5	521	21.7
IV	21, a. m.	51	110	23, p. m.	44	60	2,560	2.5	1,022	42.6
V	24, a. m.	48	94	26, p. m.	47	60	1,640	2.5	655	27.3
Sums							13,810	22.5	3,307	
Mean of 5 paths									661	27.6
Mean of 22.5 days									614	25.6
Low areas.										
I	1, p. m.	39	99	6, p. m.	51	69	2,850	5.0	570	23.7
II	3, p. m.	52	119	9, p. m.	47	59	3,680	6.0	613	25.5
III	7, p. m.	48	127	12, a. m.	50	64	4,100	4.5	912	38.0
IV	11, p. m.	31	94	14, a. m.	45	59	2,110	2.5	845	35.2
V	12, a. m.	49	127	17, a. m.	49	66	2,950	5.0	590	24.6
VI	16, p. m.	43	124	19, a. m.	47	63	3,290	2.5	1,315	54.8
VII	21, a. m.	46	127	24, a. m.	52	69	2,940	3.0	980	40.8
VIII	23, a. m.	38	124	28, a. m.	46	70	3,330	5.0	666	27.8
Sums							25,250	33.5	6,491	
Mean of 8 paths									811	33.8
Mean of 33.5 days									754	31.4

*October 31, a. m.

HIGHS.

The highs were mostly formed to the north of Montana or were detached from the rather permanent high in that region. Nos. I, II, and III had most of their course in south latitudes in the Gulf States. All of the highs, except No. III, finally reached Nova Scotia, and were last noted to the south of Newfoundland. No. III disappeared on the 16th in a subpermanent high off the South Carolina coast, which remained stationary until the 18th, p. m. Reduced pressures of 31.00 and above were frequently noted in Montana and to the north. The mean of 30.27 at Havre was the highest mean November pressure ever noted in that region. There was also an abnormally high pressure in the southeast States, reaching 30.26 at Raleigh and Wilmington, which is the highest mean November pressure noted in the South Atlantic States.

LOWS.

All of the low areas of the month, except Nos. I and IV, originated on or off the north Pacific Coast, No. I was first noted p. m. of 1st in Kansas, and No. IV p. m. of 11th in east Texas. The general trend of the lows was to the east and a little south of east till the Mississippi Valley was reached, when they turned northeast, and nearly all crossed a point just to the east of Lake Superior. All the lows disappeared in or near the Gulf of St. Lawrence. No. I was very severe in the Lake Region on the 5th; Buffalo reported 68 miles per hour, and Detroit 52 miles on afternoon of that day. No. III caused 48 miles at Chicago on p. m. of 10th, and 38 miles at Sault Ste. Marie on a. m. of 11th, Buffalo also reported 60 miles per hour on afternoon of 11th. When No. VIII reached the Lake Region it caused winds of 52 miles at Chicago, a. m. of 27th.

A remarkable feature of the storms of this month was the very great velocity, 54.8 miles hourly for No. VI. Both the high area and low area velocity between the 16th and 24th was quite abnormal, averaging 46.1 miles per hour for the two lows and one high. This would seem to show a common origin for the motion of these conditions. It should be borne in mind, however, that during this same period there were subpermanent highs nearly stationary to the north of Montana and in the southeast Atlantic States.

LOCAL STORMS.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

There were but two local storms properly so-called during November. Severe general storms, using that term as indicating a storm of wide extent, swept over the Lake Region on the 5th and 10th. Unusually heavy rains, at times mixed with snow and sleet, fell in Washington, Oregon, and Idaho on the 11th, 12th, 13th, 14th, 15th, and 16th, producing dangerous floods in the rivers and small streams. Travel was interrupted, transportation lines damaged, bridges washed away, and much movable property was swept down the rivers.

On the 23d an area of low pressure appeared on the California coast. It moved a little south of east, and on the morning of the 25th covered south-central Utah. About 3 p. m., central time, of the last-named date a minor tornado occurred in McLennan County, Tex., passing near the little town of Mart. One person was killed and three injured. Two dwelling houses were completely destroyed and five injured. The property loss was about $2,000; path of greatest destruction, 30 to 60 yards wide and about 8 miles long. Moved northeast.

On the morning of the 26th the storm center covered Iowa, eastern Kansas, and northwestern Missouri. The temperature gradients westward were exceedingly sharp, and high winds and snow prevailed northward to the British boundary and westward to the Rocky Mountain Region, while the temperature of springtime prevailed over the southern Mississippi Valley and the Gulf Coast.

A minor tornado was observed at 10.30 p. m., central time, near Tunica, Miss. One person was killed and one injured. Property loss was about $1,500. Path 300 yards wide; length unknown. Storm said to have moved northwest.

Strong winds and gales were reported in southern Illinois and western Kentucky. Press dispatches state that houses were blown down at Kuttawa, Eddyville, and Mayfield. No lives lost.

From four to eight lives were lost in Minnesota and the Dakotas as a result of the severity of the weather during the 26th and 27th.

LOCAL STORMS IN OCTOBER, 1896.

A West India hurricane moved slowly northeastward, but at some distance from the Atlantic Coast line on the 10th, 11th, 12th, and 13th, causing very high tides and dangerous gales, especially on the New Jersey, Long Island, and New England coasts. Much damage was done to bulkheads, wharves, piers, and other property on the immediate shore line. Beach property on the New Jersey and Long Island coasts suffered heavily. Probably half a million dollars will be required to repair and replace the property damaged and destroyed.

Minor tornadoes occurred in Texas, Oklahoma, Arkansas, Louisiana, and Mississippi, on the 22d, 28th, and 29th. The record in detail is as follows:

1st–2d.—A succession of heavy downpours in the upper San Pedro Valley (Arizona) caused a disastrous flood in the river. Five persons were drowned, and property valued at $10,000 was destroyed.

9th.—The voluntary observer at Lake Butler, Fla., Mr. John A. King, reports that a "cyclone" (by which we presume he means merely a severe local storm) occurred near his station on this date. One dwelling and an outbuilding were destroyed. No details of the storm were reported.

22d.—A minor tornado was observed near Seguin, Tex., a little after 4 p. m., probably central time, of the 22d, by Mr. Samuel Neel. Property loss was small; path 300 feet wide

and about 6 miles long; no casualties; moved northeast; destruction confined principally to timber.

25th.—A severe wind and rain storm occurred at Santa Rosa, Cal., on this date. Dwelling houses and barns were moved from their foundations, and trees were prostrated.

28th.—The general meteorological conditions on the 28th were not greatly different from those of May 15, last. The area of low pressure on the morning map was to the northwestward. Snow was falling in the Rocky Mountain Region (on both dates), and warm southeast winds prevailed throughout the Mississippi Valley. Severe storms, and in some localities minor tornadoes, occurred in Texas, Oklahoma, and Indian Territory. The region of tornadic activity in Texas was almost identical with that traversed by the Sherman tornado (May15, 1896), but the funnel-shaped clouds were narrow, and the rotary winds were not of unusual violence. Two funnel clouds were observed at Farmington, three at Howe, and one three miles east of Sherman. The funnel clouds observed at Howe were high in the air, and no destruction was wrought by them in that vicinity. The tornado path was from 30 to 200 yards wide, and its probable length 8 or 10 miles. Six persons were injured near Howe and Farmington. The property loss was not great, probably $2,000 or $3,000 in all.

Alderson, Ind. T., was visited by a minor tornado at 3 p. m., central time, of the same date. Two persons injured; property loss about $2,500; path of destruction, 150 feet wide and one-half mile long; general progressive movement toward northeast. Press reports of tornadoes in Lincoln, Logan, and Payne counties, Okla., have not yet been verified.

Wewoka, Ind. T., was also visited by a small tornado about 10.15 p. m., central time, of the same date. Three persons were injured. Two residences, one church, one stone store building, and one warehouse were destroyed. The path of great destruction was about one-fourth mile wide and 4 miles long.

29th.—Tornadoes occurred on this date in Arkansas, Louisiana, and Mississippi. The most destructive storm passed through Tensas Parish, La., at about 11.30 a. m., probably central time. Two persons were killed and thirteen wounded; the property loss was about $15,000. The path of the storm was about 200 yards wide; length unknown; movement toward northeast. About 10 a. m., central time, a destructive storm passed through Jefferson County, Ark., striking the edge of the small hamlet of Tucker. Seven dwelling houses were totally destroyed and three people were injured; the path was about 50 yards wide, increasing at some points to one-half mile; length unknown; storm moved northeast.

The western edge of Coffeyville, Miss., was struck by a tornado at 2 p. m., central time. One person injured; property loss about $1,750. Width of path of great destruction, 150 feet; length, 750 feet; moved northeast.

The station Delay, in the eastern part of Lafayette County, Miss., was visited by a tornado at 3 p. m., probably central time, of the same date. No casualties; property loss, $2,500. Storm moved northeast.

The following account of the waterspout-tornado that visited New Orleans, La., on this date is contributed by Mr. Robert E. Kerkam, Local Forecast Official, Weather Bureau, New Orleans, La.:

The storm commenced at 4 p. m., local time, by the coming together of two large, black clouds, on the Mississippi River, almost opposite Milan street, forming a waterspout that moved down the river, crossing toward the land and first assuming tornadic form at the head of General Taylor street. A mild thunderstorm was in progress over the city at the time, but there was little lightning or thunder, and the conditions did not appear to warrant anticipating tornadic development; the temperature and pressure showed no fluctuations at the station worthy of moment during the time the local storm was in progress.

The theory advanced is that common to waterspouts striking land in this section. After leaving the water, the funnel lifted, only occasionally lowering to near the ground, at which times devastation occurred; but the cloud from which the funnel depended was heavy, and the cloud did not dissipate, or pass beyond the range of vision, after again reaching the river, until it had covered a mile or slightly more of river front.

The duration of the storm from the time it struck the head of General Taylor street until it passed Robin street in its northeastward movement to the river did not occupy more than a few minutes. Its course of movement was from southwest to northeast; funnel cloud black, surrounded by a misty, yellow covering about the lower part of the funnel; whirl from right to left, or contrary to the movements of the hands of a watch; rainfall only slight at 4 p. m., but heavy rain at 4.30 p. m., after the tornado had disappeared on the river; the noise accompanying the tornado's movement resembled a loud rumbling, similar to that of a railroad train; length of track, slightly exceeding a mile; width, variable; largest width of path of destruction about 200 feet; property destroyed estimated at from $75,000 to $100,000; no loss of life known; although it was reported that two negroes had been carried into the river, but ten persons were injured by falling or flying débris. No hail accompanied the storm, and but little lightning or thunder; after the storm passed there was a heavy fall of rain and a mild thunderstorm. The débris scattered along the path of the storm gave every indication of the usual whirling motion accompanying tornadoes; but as it consisted mostly of brick, slate roofs, etc., and as the funnel cloud frequently lifted and no material damage was done, therefore the path was not well defined, save in the last third of a mile where cotton presses and brick walls were demolished.

The local meteorological conditions at the observatory in the custom-house, distant some two miles from the tornado, were not materially affected; the temperature showed no fluctuations, there was only a very gradual rise in the pressure, as shown by the barograph, and the maximum velocity of the wind reached less than 20 miles per hour, with an extreme velocity of 24 miles per hour. The wind changed from south at 3.50 p. m., to southwest for two minutes, then to northwest for two minutes; to north for four minutes, to northwest for six minutes, with a sudden change to steady southeast from 4.05 to 4.40 p. m., local time.

Eye witnesses of the tornado differ as regards the appearance of surrounding clouds, two claiming that small funnel shapes were visible besides the general tornado funnel, and another stating that he watched the progress of the storm carefully, and noted only the one main funnel; the latter appears more credible, since the heavy clouds were at a low altitude, and a heavy rain apparent; it is possible that the masses of surrounding clouds confused the former witnesses.

Peculiar freaks of the wind were apparent along the path of the storm: At one point a bale of cotton was burst open and the cotton was strung and wound around the telegraph and other wires in the neighhood, making them appear as if sleet and ice had frozen thereon; the telegraph poles and wires at this point were not disturbed, yet they were in the direct path of the storm. In one yard a tree in the center of the yard had been torn up by the roots, but no other vegetation or trees were injured, and no trace of damage could be found on the roofs of the buildings situated immediately next the yard.

The tornado, taken as a whole, was of a mild form and could not be classed with the storms that inflicted the great damage in Louisville or St. Louis, or others of like character.

Total known fatalities by tornado during the month, 4; by lightning, 5.

TEMPERATURE OF THE AIR.

[In degrees Fahrenheit.]

The mean temperature is given for each station in Table II, for voluntary observers. Both the mean temperatures and the departures from the normal are given in Table I for the regular stations of the Weather Bureau.

The *monthly mean temperatures* published in Table I, for the regular stations of the Weather Bureau, are the simple means of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to Table II.

The *regular diurnal period* in temperature is shown by the hourly means given in Table V for 29 stations selected out of 82 that maintain continuous thermograph records.

The *distribution of the observed monthly mean* temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart IV; the lines are drawn over the Rocky Mountain Plateau region, although the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country occupied by

our observers; such isotherms are controlled largely by the local topography, and should be drawn and studied in connection with a contour map.

The *highest mean temperatures* were: Key West, 77.0; Jupiter, 75.5; Tampa, 72.0; Port Eads, 69.8; Jacksonville, 67.4. The lowest were: Havre, 3.8; Williston, 6.6; Bismarck, 7.2; Moorhead, 10.2. Among the Canadian stations the highest were: Bermuda, 68.2; Yarmouth, 41.2; Halifax, 39.5; Port Stanley, 39.0; Toronto, 38.9; Kingston, 38.8; Sydney, 37.6; Esquimault, 36.4. The lowest were: Battleford, —3.4; Edmonton, —1.6; Banff, —0.8; Qu'Appelle, —0.4.

As compared with the normal for November the mean temperature for the current month was in excess throughout the Gulf and Atlantic States and the eastern portion of the Lake Region as, also, in the southern Plateau region and south Pacific Slope. It was deficient throughout the greater portion of the Dominion of Canada, the upper Lake Region, and westward to the Pacific. The line dividing the region of excess from that of deficiency passed nearly direct from southern Newfoundland to southern California. The greatest excesses were: Raleigh, 5.5; Tampa, 5.4; Philadelphia, 5.3; Harrisburg, 5.2; Port Eads and Hatteras, 5.0. The greatest deficiencies were: Edmonton, 28.6; Havre, 27.0; Medicine Hat, 26.0; Calgary, 24.6; Bismarck, 21.7; Williston, 21.3.

Considered by districts the mean temperatures of the current month show departures from the normal as given in Table I. The greatest positive departures were: Middle Atlantic, 4.2; South Atlantic, 4.5; Florida Peninsula, 3.8. The greatest negative departures were: North Dakota, 19.6; northern Slope, 13.2; Missouri Valley and northern Plateau, 5.9; north Pacific, 6.2.

The *years of highest and lowest mean temperatures* for November are shown in Table I of the REVIEW for November, 1894. The mean temperature for the current month was the highest on record at the following stations: Jupiter, 75.5; Tampa, 72.0; Port Eads, 69.8; Jacksonville, 67.4; Savannah, 63.4; Pensacola, 63.3; Charleston, 63.1; Hatteras, 61.2; Wilmington, 60.2; Augusta, 59.8; Columbia, S.C., 59.3; Norfolk and Cape Henry, 56.8; Charlotte, 55.6; Raleigh, 55.3; Knoxville, 52.6; Lynchburg, 52.2; Baltimore, 51.0; Washington, 50.6; Vineyard Haven, 50.5; Philadelphia, 50.4; Atlantic City, 50.2; Parkersburg, 48.7; Pittsburg, 48.6; Nantucket, 48.5; Block Island, 48.2; Harrisburg, 47.6; Woods Hole, 47.1; Narragansett Pier, 46.7; Boston, 46.5; New Haven, 46.3; Columbus, 45.2; Erie, 44.6; Cleveland and Sandusky, 44.2; Albany, 44.0; Rochester, 42.6; Northfield, 37.1. The mean temperature was the lowest on record at: Havre, 3.8; Williston, 6.6; Bismarck, 7.2; Moorhead, 10.2; Miles City, 12.7; Huron, 13.6; Pierre, 15.0; Helena, 18.4; Rapid City, 20.9; St. Paul, 21.8; Minneapolis, 22.6; Sioux City, 22.4; Green Bay, 29.4; Spokane and Baker City, 30.6; Walla Walla, 33.8; Concordia, 34.4; Port Angeles, 36.9; Portland, Oreg., 38.6; Tatoosh Island, 39.7; Fort Canby, 41.0; Astoria, 41.6.

This long list of stations for which the temperature during November was either the highest or lowest on record shows that we have to do with a month whose anomalies merit special attention, both to the student of climatology and to the investigator of the ultimate causes of meteorological phenomena.

The Editor has been favored by Mr. James Berry, Chief of the Climate and Crop Service, with the four weekly charts, VIII *a*, *b* and IX *a*, *b*, which show the departures from the 10-year normal for each station and for the average of each week. Mr. Berry states that it is doubtful whether the records of the Bureau will show another series like this. The deficiencies in the upper Missouri Valley are entirely unprecedented so far as our records show, and it may be assumed that it will not recur more than once in fifty years. At Havre, Mont., the daily temperature averaged 40° below the normal for fourteen consecutive days. It will be noticed that in general the eastern half of our territory had unusual warmth, but the western half unusual cold. As these large features in the distribution of temperature must stand in some relation to the general circulation of the atmosphere, either as cause or effect, the reader is referred to a subsequent chapter in this REVIEW, by the Editor, "On the isobars at great altitudes." Meteorological reports from Europe show that there, also, the current November has been one of the coldest on record.

The *maximum and minimum temperatures* of the current month are given in Table I. The highest maxima were: 86, Key West, Shreveport, and Vicksburg (11th), and Yuma (17th); 85, Tampa (2d), Jacksonville and Montgomery (11th); 84, Jupiter (5th), New Orleans (11th), San Antonio (26th), and Los Angeles (12th). The lowest maxima were: 32, Moorhead (2d); 38, Williston (4th); 44, Duluth (16th); 45, Huron (16th); 48, Bismarck (16th); 50, St. Paul (16th). The highest minima were: 69, Key West (frequently); 64, Jupiter (9th); 53, Tampa (14th); 45, Jacksonville (30th); 43, San Diego (28th); 42, Yuma (28th) and Port Eads (30th). The lowest minima were: —33, Havre (20th); —31, Lander (27th); —26, Moorhead (29th) and Idaho Falls (28th); —25, Miles City (30th); —24, Williston (30th); —22, Helena (27th) and Bismarck (29th).

The *years of highest maximum and lowest minimum temperatures* are given in the four last columns of Table I of the current REVIEW. During the present month the maximum temperatures were the highest on record at: Vicksburg and Shreveport, 86; Montgomery, 85; Savannah, 83; Amarillo, 82; Pueblo, 81; Dubuque, 74; Portland, Me., and New Haven, 72. The minimum temperatures were the lowest on record at: Havre, —33; Lander, —31; Moorhead and Idaho Falls, —26; Miles City, —25; Helena, —22; Pueblo, —17; Spokane, —13; Walla Walla, Rapid City, and Sioux City, —9; Salt Lake City, —2; Kansas City, 4; Wichita and Carson City, 7; Amarillo, 8; Portland, Oreg., 11; Port Angeles, 12; Roseburg, 14; Astoria, 19; Fort Canby, 20; Eureka, 27; Corpus Christi, 30; San Francisco, 38.

The *accumulated monthly departures* from normal temperatures from January 1 to the end of the current month are given in the second column of the following table, and the average departures are given in the third column for comparison with the departures of current conditions of vegetation from the normal condition.

Districts.	Accumulated departures.		Districts.	Accumulated departures.	
	Total.	Average.		Total.	Average.
	°	°		°	°
New England	+ 1.7	+ 0.2	Florida Peninsula	— 7.8	— 0.7
Middle Atlantic	+ 5.9	+ 0.5	North Dakota	—16.5	— 1.5
South Atlantic	+14.3	+ 1.3	Northern Slope	— 6.8	— 0.6
East Gulf	+ 5.6	+ 0.5	North Pacific	— 4.0	— 0.4
West Gulf	+13.0	+ 1.2	Middle Pacific	— 1.0	— 0.1
Ohio Valley and Tenn.	+11.2	+ 1.0			
Lower Lake	+ 8.3	+ 1.5			
Upper Lake	+16.5	+ 1.5			
Upper Mississippi	+12.4	+ 1.1			
Missouri Valley	+ 8.0	+ 0.7			
Middle Slope	+18.6	+ 1.6			
Abilene (southern Slope)	+21.5	+ 2.0			
Southern Plateau	+ 8.7	+ 0.8			
Middle Plateau	+ 1.6	+ 0.1			
Northern Plateau	+10.8	+ 1.0			
South Pacific	+ 3.2	+ 0.3			

The *greatest daily range of temperature and the data for computing the extreme and mean monthly ranges* are given for each of the regular Weather Bureau stations in Table I. The largest values of the greatest daily ranges were: Helena, 51; Sioux City and Pueblo, 50; Carson City, 49; Rapid City, Miles City, and Amarillo, 48; Moorhead, 47; Dodge City and

Denver, 46; Wichita and Kansas City, 45. The smallest values were: Key West, 13; Jupiter and Fort Canby, 14; Tatoosh Island, 15; Point Reyes Light, 16; San Francisco and Seattle, 17; Hatteras, 18; Astoria, 19; Walla Walla, 20.

Among the *extreme monthly ranges* the largest were: Lander and Pueblo, 98; North Platte, 91; Havre and Idaho Falls, 86; Helena, 85; Denver, 84; Cheyenne and Walla Walla, 80. The smallest values were: Key West, 17; Jupiter, 20; Point Reyes Light, 27; San Francisco, 28; Tatoosh Island, 29.

MOISTURE.

The *quantity of moisture* in the atmosphere at any time may be expressed by the weight of the vapor coexisting with the air contained in a cubic foot of space, or by the tension or pressure of the vapor, or by the temperature of the dew-point. The mean dew-point for each station of the Weather Bureau, as deduced from observations made at 8 a. m. and 8 p. m., daily, is given in Table I.

The *rate of evaporation* from a special surface of water on muslin at any moment determines the temperature of the wet-bulb thermometer; an evaporometer may be so constructed as to give the *quantity* of water evaporated from a similar surface during any interval of time. Such an evaporometer, therefore, would sum up or integrate the effects of those influences that determine the temperature as given by the wet bulb; from this quantity the *average humidity of the air* during any given interval of time may be deduced.

Measurements of evaporation within the thermometer shelters are difficult to make so as to be intercomparable at temperatures above and below freezing, and they may be replaced by computations based on the wet-bulb temperatures. The absolute amounts of evaporation from natural surfaces not protected from wind, rain, sunshine, and radiation, are being measured at a few experimental stations and will be discussed in special contributions.

Sensible temperatures.—The sensation of temperature experienced by the human body and ordinarily attributed to the condition of the atmosphere depends not merely on the temperature of the air, but also on its dryness, on the velocity of the wind, and on the suddenness of atmospheric changes, all combined with the physiological condition of the observer. A satisfactory expression for the relation between atmospheric conditions and nervous sensations has not yet been obtained.

PRECIPITATION.

[In inches and hundredths.]

The *distribution of precipitation* for the current month, as determined by reports from about 2,500 stations, is exhibited on Chart III. The numerical details are given in Tables I, II, and III. The total precipitation for the current month was heavy (6 to 11 inches) in Tennessee, Kentucky, and the mountainous parts of Georgia and North Carolina, but heaviest (14 to 27 inches) on the immediate coast of Washington, Oregon, and northern California. It was least, viz, a trace over a large portion of southern Nevada and the adjacent portions of southern California and Arizona. The larger values at regular stations were: Astoria, 16.6; Fort Canby, 15.1; Pysht, 14.5; Portland, Oreg., 13.1; Roseburg, 9.9; Seattle, 9.5. The smaller values were: Yuma, 0.1; Phœnix, 0.6; El Paso, 0.04.

Details as to *excessive precipitation* are given in Tables XII and XIII.

The *years of greatest and least precipitation* for November are given in the REVIEW for November, 1890. The precipitation for the current month was the greatest on record at: Roseburg, 9.91; Marquette, 6.44; St. Paul, 5.07; Spokane, 4.85; Duluth, 3.42; Helena, 3.29; Bismarck, 3.10; Moorhead and Walla Walla, 3.09; Williston, 2.10; Huron, 1.97; Pierre, 1.92; Concordia, 1.78; Miles City, 1.37; Rapid City, 1.09. It was not the least on record at any regular station of the Weather Bureau.

The *diurnal variation*, as shown by tables of hourly means of the total precipitation, deduced from self-registering gauges kept at the regular stations of the Weather Bureau, is not now tabulated.

The *current departures* from the normal precipitation are given in Table I, which shows that precipitation was in excess throughout the northern half of the country and also in the South Atlantic States, Tennessee, and the Ohio Valley. It was slightly deficient over a narrow belt extending along the middle and the east Atlantic Coast as also from the lower Lake Region southwest to the Rio Grande Valley.

The large excesses were: Portland, Oreg., 7.3; Astoria, 6.8; Fort Canby, 6.6; Roseburg, 6.2; Eureka, 3.9; Marquette, 3.7; Spokane, 3.2. The large deficits were: Shreveport, 3.7; Palestine, 2.8; Corpus Christi, 2.7; Galveston, 2.5.

The *average departure* for each district is given in Table I. By dividing each current precipitation by its respective normal the following corresponding percentages are obtained (precipitation is in excess when the percentage of the normal exceeds 100):

Above the normal: South Atlantic, 114; Florida Peninsula, 127; Ohio Valley and Tennessee, 122; upper Lake, 139; North Dakota, 418; upper Mississippi, 114; Missouri Valley, 119; northern Slope, 230; middle Slope, 123; middle Plateau, 170; northern Plateau, 278; north Pacific, 171; middle Pacific, 158; south Pacific, 128.

Below the normal: New England, 72; middle Atlantic, 84; east Gulf, 92; west Gulf, 45; lower Lake, 75; southern Slope (Abilene), 42; southern Plateau, 56.

The *total accumulated monthly departures* from normal precipitation from January 1 to the end of the current month are given in the second column of the following table; the third column gives the percentage of the current accumulated precipitation relative to its normal value.

Districts.	Accumulated departures.	Accumulated precipitation.	Districts.	Accumulated departures.	Accumulated precipitation.
	Inches.	*Per ct.*		*Inches.*	*Per ct.*
North Dakota	+ 3.30	118	New England	— 3.60	91
Upper Mississippi	+ 1.70	105	Middle Atlantic	— 5.10	88
Missouri Valley	+ 1.00	103	South Atlantic	—11.00	78
Northern Slope	+ 1.30	109	Florida Peninsula	— 3.90	92
Southern Plateau	+ 1.30	117	East Gulf	— 7.00	87
Middle Plateau	+ 3.50	133	West Gulf	—10.30	74
Northern Plateau	+ 1.10	108	Ohio Valley and Tenn.	— 2.50	94
North Pacific	+ 7.00	114	Lower Lake	— 1.10	97
Middle Pacific	+ 4.20	117	Upper Lakes	— 1.10	97
			Middle Slope	— 1.40	94
			Abilene (southern Slope)	— 3.90	83
			South Pacific	— 1.00	90

SNOW.

The total monthly snowfall at each station is given in Table II; its geographical distribution is shown on Chart V. This chart also shows the isotherms of minimum 32° and of minimum 40° for the air within the ordinary thermometer shelter. The former isotherm is an approximate limit to possible snow, while the latter is an approximate southern limit to the regions that report frost on exposed localities.

Snowfalls of from 5 to 15 inches occurred in Maine and New Brunswick; 20 to 30 in Ontario; 15 to 35 near Lake Superior and in the Dakotas; 20 to 100 on the mountains of Colorado; 15 to 50 on those of Montana, Idaho, and California; 20 to 115 on those of Oregon, Washington, and British Columbia.

The *depth of snow on the ground* at the end of the month is given in detail in Table II, and for the winter months is also shown on Chart VI. The condition of the snow on the

ground and of the ice in the rivers on Monday of each week is also shown on the weekly charts of the Climate and Crop Service, published by the Weather Bureau during December to March, inclusive. Special reports of ice are quoted in connection with the section devoted to the River and Flood Service.

HAIL.

The following are the dates on which hail fell in the respective States:

California, 22, 23, 25, 30. Indian Territory, 25, 26, 27. Iowa, 3. Louisiana, 3, 6, 28. Mississippi, 4. Missouri, 3. New Mexico, 25. Ohio, 5. Oklahoma, 25. Oregon, 12. Texas, 2, 25, 26, 27. Washington, 5. Wisconsin, 2.

SLEET.

The following are the dates on which sleet fell in the respective States:

Alabama, 29, 30. Arizona, 25. Arkansas, 19, 26, 27, 28. Colorado, 25, 26. Connecticut, 21, 22, 29. Delaware, 21, 29. District of Columbia, 20, 29, 30. Georgia, 21, 30. Idaho, 4, 5, 9, 10, 11, 13, 18, 19, 26. Illinois, 5, 10, 11, 19, 20, 27, 28. Indiana, 5, 20, 23, 26 to 29. Iowa, 9, 10, 16, 17, 18, 20 to 28. Kansas, 9, 10, 11, 17, 19 to 22, 24 to 27. Kentucky, 27, 28, 29. Louisiana, 30. Maine, 18, 26. Maryland, 8, 20, 29, 30. Massachusetts, 13, 21. Michigan, 4 to 8, 10, 11, 15, 18, 20, 21, 24 to 27. Minnesota, 2, 17, 23 to 27. Mississippi, 28, 29, 30. Missouri, 3, 4, 5, 9 to 13, 18, 19, 20, 23, 24, 26, 27, 28. Montana, 1, 8, 14, 15, 22. Nebraska, 17, 20, 22 to 27. Nevada, 23, 25. New Hampshire, 21, 25. New Jersey, 13, 21, 29. New Mexico, 9, 10, 11. New York, 13, 18, 21, 25, 28, 29. North Carolina, 1, 29, 30. North Dakota, 2, 3, 14, 15, 18. Ohio, 8, 9, 10, 12, 13, 20, 24, 27, 28. Oklahoma, 19, 27. Oregon, 4, 7, 10, 16, 17, 22, 23, 29, 30. Pennsylvania, 20, 21, 28, 29. Rhode Island, 13, 21, 29. South Carolina, 30. South Dakota, 1, 2, 3, 6, 24 to 27. Tennessee, 27 to 30. Texas, 29, 30. Vermont, 21. Virginia, 8, 9, 13, 20, 29, 30. Washington, 1, 4, 7, 9 to 12, 15, 18, 21, 22, 23, 27 to 30. West Virginia, 28, 29, 30. Wisconsin, 4, 10, 21, 23 to 26.

SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 19 regular stations of the Weather Bureau by its photographic, and at 31 by its thermal effects. At one of these stations records are kept by both methods. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table XI for each hour of local mean time.

Photographic and thermometric registers give the duration of that intensity of sunshine which suffices to make a record, and, therefore, they generally fail to record for a short time after sunrise and before sunset, because, even in a cloudless sky, the solar rays are then too feeble to affect the self-registers. If, therefore, such records are to be used for determining the amount of cloudiness, they must be supplemented by special observations of the sky near the sun at these times. The duration of clear sky thus specially determined constitutes the so-called twilight correction (more properly a low-sun correction), and when this has been applied, as has been done in preparing Table XI, there results a complete record of the clearness of the sky from sunrise to sunset in the neighborhood of the sun. The twilight correction is not needed when the self-registers are used for ascertaining the duration of a special intensity of sunshine, but is necessary when the duration of cloudiness is alone desired, as is usually the case.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table XI.

COMPARISON OF DURATIONS AND AREAS.

The sunshine registers give the *durations* of effective sunshine whence the duration relative to possible sunshine is derived; the observers' personal estimates give the percentage of *area* of clear sky. These numbers have no necessary relation to each other, since stationary banks of clouds may obscure the sun without covering the sky, but when all clouds have a steady motion past the sun and are uniformly scattered over the sky, the percentages of duration and of area agree closely. For the sake of comparison, these percentages have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental records of percentages of durations of sunshine are almost always larger than the observers' personal estimates of percentages of area of clear sky; the average excess for November, 1896, is 7 per cent for photographic and 4 per cent for thermometric records.

The details are shown in the following table, in which the stations are arranged according to the greatest possible duration of sunshine, and not according to the *observed* duration as in previous years.

Difference between instrumental and personal observations of sunshine.

Stations.	Apparatus.	Total possible duration for the whole month.	Personal estimated area of clear sky.	Instrumental record of sunshine.			
				Photographic.	Difference.	Thermometric.	Difference.
		Hrs.	%	%	%	%	%
Tampa, Fla	T.	323.5	64	.....	.....	60	− 4
Galveston, Tex	P.	321.7	51	44	− 7	.....	.....
New Orleans, La	T.	319.7	36	.....	.....	35	− 1
Savannah, Ga	P.	315.9	50	52	+ 2	.....	.....
Vicksburg, Miss	T.	315.9	67	.....	.....	69	+ 2
Phœnix, Ariz	P.	314.0	69	81	+12	.....	.....
San Diego, Cal	P.	314.0	73	78	+ 5	.....	.....
Atlanta, Ga	T.	312.2	50	.....	.....	49	− 1
Los Angeles, Cal	P.	312.2	62	.....	.....	.....	.....
Wilmington, N. C	T.	312.2	60	.....	.....	60	0
Chattanooga, Tenn	T.	310.1	40	.....	.....	41	+ 1
Little Rock, Ark	T.	310.1	40	.....	.....	51	+11
Raleigh, N. C	T.	308.3	53	.....	.....	61	+ 8
Santa Fe, N. Mex	P.	308.3	69	85	+16	.....	.....
Fresno, Cal	T.	305.7	58	.....	.....	67	+ 9
Dodge City, Kans	P.	304.0	59	62	+ 3	.....	.....
Louisville, Ky	T.	304.0	31	.....	.....	43	+12
San Francisco, Cal	T.	304.0	51	.....	.....	60	+ 9
Baltimore, Md	T.	301.5	37	.....	.....	29	− 8
Cincinnati, Ohio	T.	301.5	36	.....	.....	38	+ 2
Kansas City, Mo	P.	301.5	48	53	+ 5	.....	.....
St. Louis, Mo	T.	301.5	36	.....	.....	46	+10
Washington, D. C	P.	301.5	44	47	+ 3	.....	.....
Columbus, Ohio	T.	299.7	25	.....	.....	28	+ 3
Denver, Colo	T.	299.7	53	80	+27	.....	.....
Indianapolis, Ind	T.	299.7	42	.....	.....	50	+ 8
Philadelphia, Pa	T.	299.7	41	.....	.....	53	+12
Cheyenne, Wyo	P.	297.3	45	66	+21	.....	.....
Eureka, Cal	P.	297.3	41	43	+ 2	.....	.....
New York, N. Y	T.	297.3	39	.....	.....	51	+12
Omaha, Nebr	P.	297.3	47	51	+ 4	.....	.....
Salt Lake City, Utah	P.	297.3	23	42	+19	.....	.....
Binghamton, N. Y	T.	294.9	36	.....	.....	36	0
Boston, Mass	T.	294.9	31	.....	.....	37	+ 6
Chicago, Ill	T.	294.9	36	.....	.....	36	0
Cleveland, Ohio	T.	294.9	20	.....	.....	26	+ 6
Des Moines, Iowa	T.	294.9	41	.....	.....	44	+ 3
Detroit, Mich	T.	294.9	27	.....	.....	35	+ 8
Dubuque, Iowa	T.	294.9	32	.....	.....	28	− 4
Buffalo, N. Y	T.	292.3	21	.....	.....	23	+ 2
Rochester, N. Y	T.	292.3	25	.....	.....	24	− 1
Northfield, Vt	P.	289.7	21	22	+ 1	.....	.....
Portland, Me	T.	289.7	29	.....	.....	40	+11
Eastport, Me	P.	287.2	23	27	+ 4	.....	.....
Minneapolis, Minn	T.	287.2	.....	.....	.....	29	.....
Portland, Oreg.*	T.	284.1	35	.....	.....	23	+12
	P.	284.1	35	23	+12	.....	.....
Bismarck, N. Dak	P.	281.0	31	30	− 1	.....	.....
Helena, Mont	P.	281.0	35	36	+ 1	.....	.....
Seattle, Wash	T.	278.0	31	.....	.....	22	− 9

WIND.

The *prevailing winds* for November, 1896, viz, those that were recorded most frequently, are shown in Table I for the regular Weather Bureau stations.

The *resultant winds*, as deduced from the personal observations made at 8 a. m. and 8 p. m., are given in Table IX. These latter resultants are also shown graphically on Chart IV, where the small figure attached to each arrow shows the number of hours that this resultant prevailed, on the assumption that each of the morning and evening observations represents one hour's duration of a uniform wind of average velocity. These figures indicate the relative extent to which winds from different directions counterbalanced each other.

HIGH WINDS.

Maximum wind velocities of 50 miles or more per hour were reported during this month at regular stations of the Weather Bureau as follows (maximum velocities are averages for five minutes; extreme velocities are gusts of shorter duration, and are not given in this table):

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
		Miles				*Miles*	
Amarillo, Tex	5	56	s.	Fort Canby, Wash	12	80*	s.
Do	26	52	w.	Do	13	66*	s.
Bismarck, N. Dak	26	54	nw.	Do	14	76	s.
Do	27	51	nw.	Do	30	58	se.
Buffalo, N. Y	5	66	w.	Huron, S. Dak	22	56	se.
Do	6	72	w.	New York, N. Y	5	52	se.
Do	11	56	w.	Do	14	50	nw.
Cairo, Ill	26	51	s.	Rapid City, S. Dak	16	54	sw.
Chicago, Ill	27	53	w.	Sault Ste. Marie, Mich.	8	52	nw.
Detroit, Mich	5	52	sw.	Tatoosh Island, Wash.	12	50	s.
Fort Canby, Wash	1	82	se.	Do	14	50	w.
Do	4	60	se.	Do	19	50	e.
Do	7	58	s.	Winnemucca, Nev	9	50	sw.
Do	8	58	s.	Woods Hole, Mass	15	52	sw.

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table X, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—The dates on which reports of thunderstorms for the whole country were most numerous were: 3d, 41; 12th, 53; 25th, 73; 26th, 45.

Thunderstorm reports were most numerous in: Illinois, 33; Louisiana, 36; Nebraska, 31; Tennessee, 37.

Thunderstorms were most frequent in: Illinois, 9 days; Louisiana, 13; Mississippi and Texas, 10.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from the 15th to the 23d, inclusive. On the remaining twenty-one days of this month 52 reports were received, or an average of about 2.5 per day. The dates on which the number of reports especially exceeded this average were: 5th, 5; 6th, 12; 7th, 8.

Auroras were reported most frequently in: Massachusetts and Nebraska, 4 days; Ohio, 8; Wisconsin, 6.

The number of reports was a large percentage of the number of observers in: Delaware, 33; Rhode Island, 12; Wisconsin, 10; South Dakota, 7; Ohio, 6.

CANADIAN REPORTS.

Thunderstorms were reported from Rockliffe and Parry Sound on the 18th.

Auroras were reported as follows: Grindstone, Grand Manan, Charlottetown, Father Point, and Prince Albert, 7th; Minnedosa, 13th, 18th; Qu'Appelle, 19th, 20th; Medicine Hat, 8th; Swift Current, 22d; Battleford, 6th, 7th; Banff, 5th, 6th, 9th.

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective services.

Snowfall and rainfall are expressed in inches.

Alabama.—The mean temperature was 57.6°, or 4.7° above normal; the highest was 90°, at Healing Springs on the 12th, and the lowest, 14°, at Hamilton on the 29th. The average precipitation was 4.20, or 0.36 above normal; the greatest monthly amount, 7.67, occurred at Elba, and the least, 0.54, at Pineapple. There has been rain sufficient to give navigable stages to the larger rivers, and the scarcity of water of October and preceeding months is relieved to a great extent by the heavy showers of the first and latter part of the month.

Arizona.—The mean temperature was 55.2°, or 0.2° above normal; the highest was 98°, at Maricopa, and the lowest, 10°, at Holbrook on the 30th. The average precipitation was 0.73, or 0.12 below normal; the greatest monthly amount, 3.60, occurred at Maricopa; no rain fell at Casa Grande, 20 miles southeast of Maricopa.

Arkansas.—The mean temperature was 52.8°, or 2.9° above normal; the highest was 88°, at Picayune on the 10th and Elon on the 11th, and the lowest, 8°, at Keesees Ferry on the 30th. The average precipitation was 4.33, or normal; the greatest monthly amount, 9.51, occurred at Arkansas City, and the least, 1.26, at Fulton.

California.—The mean temperature was 52.1°, or 1.3° above normal; the highest was 97°, at Pomona on the 15th, and the lowest, 17° below zero, at Bodie on the 27th. The average precipitation was 4.39, or 1.96 above normal; the greatest monthly amount, 23.87, occurred at La Porte, in the mountain regions of Plumas County, and the least, "trace," at Needles, in the desert regions of San Bernardino Colorado.

Colorado.—The month was marked by unusually high and low temperatures, the former occurring generally on the 15th and 16th east of the Continental Divide, and the latter from the 25th to the close of the month throughout the State. The highest was 83°, at Minneapolis (in the southeastern section of the State) on the 16th, and the lowest, 25° below zero, at Breckenridge and Steamboat Springs on the 28th, and Hot Sulphur Springs on the 29th. The average precipitation was 0.69, or 0.09 below normal; the greatest monthly amount, 9.30, occurred at Ruby, while none fell at several stations.

Florida.—The mean temperature was 70.1°, or nearly 4.0° above normal; the highest was 90°, at Orange Park on the 3d and Plant City on the 12th, and the lowest, 34°, at Pensacola on the 30th. The average precipitation was 3.33, or 0.37 above normal; the greatest monthly amount, 13.17, occurred at Milton, and the least, 0.64, at Frostproof.

Georgia.—The mean temperature was 58.5°, or about 4.8° above normal; the highest was 85°, at Fleming on the 12th; the lowest, 22°, at Diamond and Ramsey on the 9th. The average precipitation was 5.72, or 2.62 above normal; the greatest monthly amount, 11.89, occurred at Clayton, and the least, 2.18, at Albany.

Idaho.—The mean temperature was 29.4°; the highest was 80°, at Payette on the 1st, and the lowest, 38° below zero, at Chesterfield on the 26th. The average precipitation was 3.75; the greatest monthly amount, 11.12, occurred at Murray, and the least, 0.73, at Burnside. The month opened with rainfall and mild temperatures in all parts of the State; these conditions were the rule, with slight variations, until the 26th, when a sudden and severe cold wave was experienced, accompanied by high winds and heavy snowfall; the month closed with intensely cold weather prevailing in all sections. At the end of the month the entire State, except the extreme southern section, was covered with snow in depths ranging from 2 to 22 inches, the latter being reported at Lake.

Illinois.—The mean temperature was 40.4°, or 1.3° above normal; the highest was 80°, at Mount Vernon on the 17th and Rose Hill on the 2d and 17th, and the lowest, 2° below zero, at La Harpe on the 28th and Scales Mound on the 30th. The average precipitation was 2.72, or 0.42 below normal; the greatest monthly amount, 6.92, occurred at Rose Hill, and the least, 0.65, at Reynolds.

Indiana.—The mean temperature was 44.2°, or 3.2° above normal;

the highest was 79°, at Washington on the 18th, and the lowest, 5°, at Lafayette on the 30th. The average precipitation was 3.24, or 0.52 below normal; the greatest monthly amount, 5.44, occurred at Worthington, and the least, 1.19, at Logansport.

Iowa.—The mean temperature was 29.6°, or 4.5° below normal; the highest was 82°, at Belknap on the 16th, and the lowest, 15° below zero, at Rock Rapids on the 30th. The average precipitation was 1.83, or 0.07 above normal; the greatest monthly amount, 4.51, occurred at Spencer, and the least, 0.16, at Atlantic.

Kansas.—The mean temperature was 37.7°, or 3.1° below normal; the highest was 82°, at Achilles on the 16th, and the lowest, 13° below zero at Norton on the 27th. The average precipitation was 0.92, or 0.01 above normal; the greatest monthly amount, 3.14, occurred at Columbus, and the least, "trace," at Fort Riley, Lakin, Phillipsburg, and Ulysses.

Kentucky.—The mean temperature was 49.3°, or 4.0° above normal; the highest was 80°, at Henderson and Russellville on the 18th, and Ashland on the 25th, and the lowest, 11°, at Richmond on the 30th. The average precipitation was 5.01, or 0.99 above normal; the greatest monthly amount, 6.98, at Caddo, and the least, 3.03, at Richmond. The weather throughout the month was favorable for all agricultural interests at this season. Excessive heat and well-distributed rains stimulated the growth of winter grain and kept the pastures fresh and green to an extent that is without precedent in November.

Louisiana.—The mean temperature was 61.8°, or 3.6° above normal; the highest was 92°, at Covington on the 19th, and the lowest, 20°, at Minden on the 29th. The average precipitation was 5.22, or 1.31 above normal; the greatest monthly amount, 9.78, occurred at Thibodeaux, and the least, 1.08, at Shreveport.

Maryland.—The mean temperature was 49.4°, or 6.0° above normal; the highest was 78°, at Millsboro on the 1st, Milford on the 28th, and Westernport on the 27th, and the lowest, 12°, at Sunnyside on the 30th. The average precipitation was 3.08, or 0.05 above normal; the greatest monthly amount, 6.92, occurred at Milford, and the least, 1.08, at Charlotte Hall School. Twenty-nine stations reported snowfall during the month, the amounts ranging from "trace" at McDonogh School to 6 inches at Darlington.

Michigan.—The mean temperature was 35.6°, or 0.6° above normal; the highest was 72°, at Grape on the 3d, and the lowest, 12° below zero, at Iron River on the 30th. The average precipitation was 3.47, or 0.57 above normal; the greatest monthly amount, 6.80, occurred at Gaylord, and the least, 1.36, at Thornville.

Minnesota.—The mean temperature was 18.0°, or 6.6° below normal; the highest was 67°, at La Crosse on the 16th, and the lowest, 39° below zero, at Tower on the 29th. The average precipitation was 2.69; the greatest monthly amount, 5.47, occurred at Worthington. The cold of November, 1880, was more severe than the cold of this month, but since then it has not been equaled, and records at Minneapolis show that aside from 1880, in only two years (1872 and 1875) has the cold been as great as this year, since 1864. On the 25th and 26th there was general and very heavy precipitation in the northern part of the country, as a severe blizzard in western and northern Minnesota and westward, and as heavy rain in the southeastern part of the State. After the passage of the "low," during the 26th, a cold wave set in, causing intense suffering in all sections and the loss of at least four lives in this State. Much loss of cattle will probably result, and also of unthrashed grain, of which there is considerable. Railroad traffic has been very seriously hindered, and at the close of the month several lines were not yet open.

Mississippi.—The mean temperature was 58.6°, or 5.0° above normal; the highest was 88°, at Magnolia, Natchez, and Yazoo City on the 11th, and Hazlehurst on the 12th; the lowest was 17°, at French Camp on the 9th. The average precipitation was 3.92, or 0.72 below normal; the greatest monthly amount, 8.13, occurred at Austin, and the least, 0.63, at Okolona.

Missouri.—The mean temperature was 42.3°, or 0.8° above normal; the highest was 82°, at Mount Vernon on the 15th, and the lowest, 5° below zero, at Maryville on the 30th. The average precipitation was 2.21, or 0.23 below normal; the greatest monthly amount, 6.80, occurred at Gayoso, and the least, 0.70, at Oregon.

Montana.—The mean temperature was 18.0°, or 11.0° below normal; the highest was 73°, at Wibaux on the 15th, and the lowest, 42° below zero, at Fort Logan on the 28th. The average precipitation was 2.40, or 0.25 above normal; the greatest monthly amount, 8.61, occurred at Libby, and the least, 0.90, at Chinook.

The month of November was remarkable. During the middle portion of the month warm weather was general over the State, with warm chinook winds. From the middle until the end of the month cold weather occurred, nothing like it having been known for the month of November in the history of the State. For days in succession the temperature registered below the zero point. The cold wave was accompanied by heavy snows, and in some sections high winds. The following remarks are furnished by observers:

Butte: Warm and partly cloudy weather up to the afternoon of the 17th, when a fall of snow, accompanied by high winds, occurred. The wind seemed to whirl in every direction. The snow lasted only a short time, after which the temperature fell from 50° to 27°. The lowest temperature for the month was —24°.

Choteau: Up to the morning of the 16th the weather was about normal, with a light snowfall on the 9th. From the morning of the 16th until the close of the month weather conditions quite the reverse obtained. Snow to the depth of 10 inches in the next four days, with a minimum temperature of —30; near this point the temperature hovered until the end of the month. The weather was very severe on live stock, and, where it could not be fed, much suffering was sustained or threatened. The snow was much deeper 18 miles north of this station.

Glendive: Unless relief comes soon the loss of stock will be large. Many frozen sheep are thrown out of the yards every morning. The outlook is bad for sheep and cattle in this portion of the State.

Great Falls: On the 13th chinook winds began during the night and continued on the 14th, increasing in force, blowing directly from the southwest all day. On the 15th chinook winds continued up to about 12.25 p. m. when a sudden change in temperature, but not in direction of wind, which was from the same direction. Temperature fell in an incredibly short time from 44° to 23°. The cold blast seemed to have dropped from the sky without any noticeable change in wind direction. About 4.15 p. m. a sudden change took place bringing the temperature up to 54° from which point it fell gradually to 19° at sunset. Snow began during the night of the 16th, and fell at intervals until the 19th. Mr. Herzog is of the opinion "that the sudden changes in temperature are probably due to two currents of wind (upper and lower) of different temperatures, and that these currents change places and produce the waves. At times a chinook is preceded by a cold southwest wind, again it follows the chinook, then again a cold wave is suddenly experienced, lasting a short time when again the chinook prevails. Close observations fail to note any changes in wind direction, so that the modulation of the waves must be upward and downward."

Havre: The weather at this station during the latter portion of the month was a record breaker, so far as precipitation and temperature was concerned. With a minimum temperature of —32° on the morning of the 20th, and with temperatures below zero fourteen days in succession, the outlook is very discouraging to the stock interests. Snow covered the ground to a depth of 14 inches on the 26th, and a severe cold wave prevailed in this section until the end of the month.

Helena: Very high temperatures occurred from the 13th up to 7.45 a. m. of the 16th; at that hour the temperature registered 57° from which point a sudden fall, almost instantaneous, of 27° occurred. At 10 a. m. the temperature registered 17°. Extreme cold weather continued from the above date until the end of the month. On the morning of the 28th a minimum of —22° was recorded, this being the lowest on record for the month of November. The heavy snowfall interrupted street car traffic and train service. Cattlemen state that it is their opinion that the exceptional temperature conditions and the excessive snowfall during the month will result in some loss of stock, coming as it does so early in the season.

Kipp: The temperature on the 14th rose from —6° to 49° at 3 p. m. and remained at that point until 3.55 p. m., when the wind veered to the northeast and sleet began falling and continued until 4 p. m. of the 15th, then changing to a furious snowstorm. During the p. m. of the 14th heavy rain fell in the mountains, causing the streams to rise, flooding the lowlands, and drowning a great many cattle. On the night of the 17th 29 inches of snow remained on the ground.

Nebraska.—The mean temperature was 26.1°, or 8.8° below normal; the highest was 85°, at Beaver City on the 16th, and the lowest, 22° below zero, at Lodge Pole on the 27th. The average precipitation was 1.21, or 0.53 above normal; the greatest monthly amount, 3.85, occurred at Harrington, and the least, "trace," at several stations.

Nevada.—The mean temperature was 35.6°, or 2.0° below normal; the highest was 79°, at Downeyville on the 14th, and the lowest, 23° below zero, at Wells on the 27th. The average precipitation was 1.10, or 0.39 above normal; the greatest monthly amount, 4.29, occurred at Stofiel, and the least, "trace," at Candelaria.

New England.—The mean temperature was 42.0°, or 4.0° above normal; the highest was 74°, at Lake Cochituate, Mass., on the 17th, and the lowest, 11° below zero, at Fort Fairfield, Me., on the 23d. The average precipitation was 0.83 below normal; the greatest monthly amount, 6.05, occurred at Cohasset, Mass., and the least, 1.95, at Kineo, Me. This month will be recalled as excelling all previous Novembers as to mild weather. The average daily excess in temperature was 4°, and at some places the monthly mean was higher than the normal by more than 6°. At Boston the mean was the highest for this month since the establishment of the station in 1871, and the maximum temperature of 72° on the 27th broke the record for the third decade of the month. In fact, at nearly all the Weather Bureau stations in New England the monthly means were the highest ever noted in November, and the same may be safely said of many of the voluntary stations. The weather was favorable for all outdoor work. Grass was very green for the season; at Worcester, Mass., dandelions were in blossom. Winter grain will enter the coming season in good condition.

New Jersey.—The mean temperature was 48.2°, or 6.1° above normal; the highest was 83°, at Barnegat on the 2d, and the lowest, 12°, at Dover on the 23d. The average precipitation was 3.05, or 0.68 below

normal; the greatest monthly amount, 5.68, occurred at Charlotteburg, and the least, 1.37, at Barnegat.

New Mexico.—The highest temperature was 87°, at Eddy on the 18th, and the lowest, 19° below zero, at La Belle on the 29th. The precipitation was light throughout the Territory; the greatest monthly amount, 2.15, occurred at Chama; no precipitation fell at several stations.

New York.—The mean temperature was 42.4°, or 4.6° above normal; the highest was 76°, at Addison on the 18th, and the lowest, 1° below zero, at Canton and Saranac Lake on the 22d. The average precipitation was 2.83, or 0.14 below normal; the greatest monthly amount, 6.21, occurred at North Lake (Atwell P. O.), and the least, 0.60, at Tyrone. The unusually warm weather permitted plowing to be carried on even in most northern counties until the 28th.

North Carolina.—The mean temperature was 54.8°, or 5.1° above normal; the highest was 86°, at Newbern on the 12th, and the lowest, 15°, at Highlands on the 9th. The average precipitation was 4.67, or 1.33 above normal; the greatest monthly amount, 12.15, occurred at Horse Cove, and the least, 1.52, at Newbern. The month was remarkably mild and pleasant and the warmest November on record.

North Dakota.—The mean temperature was 8.1°, or 20.3° below normal; the highest was 62°, at Medora on the 15th, and the lowest, 32° below zero, at Fargo on the 29th and Hamilton on the 30th. The average precipitation was 2.23, or 1.75 above normal; the greatest monthly amount, 4.33, occurred at Mayville, and the least, 0.74, at Minto.

The temperature and precipitation departures were the greatest ever recorded since the establishment of the service, the former being 20° deficient, and the latter 1.75 inches in excess of the normal. The great storm that passed over the State on the 26th was one of the most severe, if not the most, that was ever experienced. Eight lives are now known to have been lost in it, and many more are reported as missing and have not as yet been accounted for, and owing to the sparsely settled condition of the State, as well as the fact that all roads are almost impassable, making communication very difficult, the particulars will not be known for a long time. While the loss of life was comparatively large, the loss of live stock will probably reach a very high figure, and as the ground is covered to a depth of nearly two feet with snow, it will be likely to cause more losses before spring.

Ohio.—The mean temperature was 45.1°, or 4.4° above normal; the highest was 79°, at Thurman on the 1st, Bellefontaine on the 5th, and Ripley on the 27th; and the lowest, 7°, at Orangeville on the 30th. The average precipitation was 2.63, or 0.4 below normal; the greatest monthly amount, 5.50, occurred at Fayette, and the least, 0.93, at Bellefontaine. Snow afforded but little protection to wheat during cold weather. Farm work made excellent progress and pastures are fairly good for time of year.

Oklahoma.—The mean temperature was 47.3°; the highest was 91°, at Norman on the 17th, and the lowest, zero, at Beaver on the 29th. The average precipitation was 1.83; the greatest monthly amount, 3.48, occurred at Burnett, and the least, 0.19, at Beaver. Generally, winter wheat is in first class condition, and is all, except very late planted, well matted over the ground, and in excellent shape for the winter.

Oregon.—The mean temperature was 38.6°, or 6.8° below the 5-year normal. In the coast district the mean temperatures ranged from 37° to 51°; in the Willamette Valley district from 35° to 40°; in the southern Oregon district from 40° to 43°, and in the eastern Oregon district from 27° to 38°. The greatest deficiency in temperature occurred in eastern Oregon; the highest temperature was 71°, at Pendleton on the 15th; the lowest was 32° below zero, at Silver Lake on the 26th and 27th, or 33° lower than the next lowest November temperature ever reported since 1888. The average precipitation for the State was 12.64, or 7.30 more than the normal. The monthly amounts ranged from 12 to 39 inches in the coast district; from 11 to 20 inches in the Willamette Valley district; from 5 to 10 inches in the southern Oregon district, and from 1 to 24 inches in the eastern Oregon district. All previous precipitation records were broken this month. Glenora reported 7.68 inches of rain on the 13th. Snow fell in all parts of the State, except a few places on the immediate coast. The snowfall ranged from 0.2 inch to 9.5 inches in western Oregon and from 0.5 inch to 44.5 inches in eastern Oregon. The mountain station at Government Camp (7,000 feet elevation) reported 74.0 inches of snow during the month. Briefly, November, 1896, in Oregon, was a phenomenal month, all records of temperature, precipitation, wind, and height of rivers having been broken. The weather was unfavorable to fall plowing and seeding. The great freezeup on the 27–29th greatly damaged the potato crops, which will be considerably short of the average by next spring. On the other hand, the extreme cold was beneficial to fruit trees and resulted in the extermination to a great extent of all manner of pestiferous insects.

Pennsylvania.—The mean temperature was 46.0°, or 6.0° above normal; the highest was 83°, at Confluence on the 28th, and the lowest, 12°, at Blooming Grove on the 23d. The average precipitation was 3.55, or 0.32 above normal; the greatest monthly amount, 8.05, occurred at Girardville, and the least, 0.82, at Wellsboro.

South Carolina.—The mean temperature was 59.1°, or 4.7° above normal; the highest was 90°, at Cheraw on the 12th, and the lowest, 26°, at Clemson College on the 9th. The average precipitation was 4.00, or 1.39 above normal; the greatest monthly amount, 9.48, occurred at Greenville, and the least, 1.12, at St. Matthews.

South Dakota.—The mean temperature was 16.5°, or 17.2° below normal; the highest was 70°, at Oelrichs and Rapid City on the 16th, and the lowest, 29° below zero, at Webster on the 30th. The average precipitation was 1.55, or 1.07 above normal; the greatest monthly amount, 2.88, occurred at Mellette, and the least, 0.45, at Chamberlain.

The month was an unusually cold one and was really a winter month all through. Although in some former years the minimum temperature has been lower the average daily temperature during this November continued persistently low most of the time. The principal meteorological feature of the month, other than the unusually low temperature, was the storm of the 25th, 26th, 27th. This storm started in most localities with rain and sleet, turning to snow, with high northerly winds. It began on the 25th and continued until the 27th. During the day and night of 26th it developed into a severe winter storm of snow and high wind, especially over the north, northeast, west, and southwest portions of the State. It was compared in many localities with the storm of January 12, 1888, but so far as can be learned the wind was not near so high, generally, and the temperature did not reach so low a point. The sleet on the 26th was extraordinarily heavy in the east and southeast portions of the State, and it is reported that in many localities its weight stripped some of the trees of most of the smaller branches and limbs. Telegraph lines were prostrated in all directions and in many places the poles were broken off. While there is very little loss of live stock reported from sections where shelter was available it is reported that there were some heavy individual losses on the ranges. The death of several persons is also reported from the ranges west of the Missouri River, who were out with stock and became lost in the storm. As near as can be learned the sleet of the 26th was the heaviest known in the east and southeast portion of the State.

Tennessee.—The mean temperature was 51.5°, or 3.8° above normal; the highest was 80°, at Dyersburg on the 1st, and the lowest, 13°, at Jacksonville on the 9th. The average precipitation was 6.56, or 2.66 above normal; the greatest monthly amount, 9.76, occurred at Molino, and the least, 3.79, at Springdale.

Utah.—The mean temperature was 33.4°; the highest was 78°, at St. George on the 15th, and the lowest, 20° below zero, at Soldier Summit on the 12th. The average precipitation was 1.23; the greatest monthly amount, 3.49, occurred at Huntsville, and the least, "trace," at Giles.

Virginia.—The mean temperature was 51.3°, or 4.0° above normal; the highest was 83°, at Bonair and Nottoway on the 18th, and the lowest, 10°, at Hot Springs on the 30th. The average precipitation was 3.84, or 1.36 above normal; the greatest monthly amount, 6.16, occurred at Burke's Garden, and the least, 1.96, at Birdsnest.

Washington.—The mean temperature was 33.8°, or 8.0° below normal; the highest was 73°, at Kennewick on the 15th, and the lowest, 29° below zero, at Ellensburg on the 28th. The average precipitation was 9.16, or 3.81 above normal; the greatest monthly amount, 19.39, occurred at Union City, and the least, 1.49, at Sunnyside. In more ways than one it was the most remarkable November weather in the memory of the oldest inhabitant. The cold spell from the 25th to the 30th was such a severe one as has never been known in November before, either by the whites, or by their predecessors, the Siwash. It has rarely been equaled even in midwinter. In all parts of the State east of the Cascades, and in some parts west of them the temperature fell below zero. The rainfall was entirely unprecedented during the first two weeks, and in conjunction with the warm wave, or chinook winds which culminated on the 13th, caused the highest floods in the rivers flowing west of the Cascades ever known by the white settlers.

West Virginia.—The mean temperature was 48.1°, or about 4.0° above normal; the highest was 80°, at Philippi on the 2d, and the lowest, 10°, at Bluefield on the 30th. The average precipitation was 3.50, or 0.25 above normal; the greatest monthly amount, 5.07, occurred at White Sulphur Springs, and the least, 1.56, at Bloomery.

Wisconsin.—The average temperature for the month of November was 28°, which is 2.8° below normal. The greatest deficiency in temperature occurred in the northwestern section of the State and ranged from 5° to 10° daily. The average temperature in the northern portion of the State was 23.4°, which is 3.8° below the November normal for that section. The average temperature for the central portion of the State was 27.7°, or 2.5° below normal, while for the southern section the average temperature, 32.8°, was slightly higher than normal. The highest temperature for the month occurred generally on the 16th, but during the latter part of the month another warm wave passed over the State, resulting in temperatures nearly as high as those occurring on the 16th. On the 26th a cyclonic storm of marked energy passed over the State; the temperature rose very rapidly, reaching a remarkable height. At Milwaukee on the 26th the temperature reached 61°, which is 3° higher than any previous record for the last ten days of November since the establishment of the Weather Bureau in this State. Equally high temperatures were reported from other portions of the State on this date. The abnormal heat was followed by the opposite extreme, and when the storm center had passed eastward so as to bring Wisconsin within the sweep of

the northerly winds of the approaching anticyclone, the temperature fell with great rapidity, reaching the zero mark at nearly all stations in the central and northern sections by the morning of the 28th. The cold wave was remarkable for its persistency, and the temperature continued to fall during the remaining days of the month, generally reaching the lowest point on the 30th. The rapidity with which the temperature fell on the approach of the cold wave was remarkable, as is indicated by the following twenty-four hour changes: At Boscobel the temperature fell 55°; Crandon, 61°; Waukesha, 52°; Gratoit, 61°, and Madison, 50°. The lowest temperature reported in the State was 18° below zero, at Hayward on the 22d.

The average precipitation for the entire State was 2.87 inches, which is 0.98 of an inch in excess of the November normal. The average amount and departure from the normal, by sections, is as follows: Northern section, 3.91, an excess of 1.79; middle section, 2.76, excess, 1.09; southern section, 1.92, excess, 0.05. It will be noted that the heaviest precipitation occurred in the northern section, and the amount gradually decreased toward the southern portion of the State. The heaviest precipitation for the month was 6.74 inches, at Appollonia, 5.00 inches of which fell during the storm of the 25th and 26th. The recent floods in the Chippewa Valley were undoubtedly due largely to the excessive rains which accompanied this storm, and a careful examination of the records of those stations located about the headwaters of that stream would indicate that the average amount of precipitation over the districts drained by the Chippewa River was about 2.00 inches during the continuance of the storm. This amount of precipitation would of itself be sufficient to raise the river to a high stage, but not sufficient to produce a destructive flood, and had the river been free from ice there is every reason to believe that the channel is amply sufficient to have carried off the water without doing any damage to the lowlands along its border.

Wyoming.—The mean temperature was 23.7°, or 7.0° below normal; the highest was 72°, at Sheridan on the 15th, and the lowest, 31° below zero, at Lander on the 27th. The average precipitation was 1.06, or 0.50 above normal; the greatest monthly amount, 3.92, occurred at Fort Yellowstone, and the least, 0.09, at Laramie.

RIVER AND FLOOD SERVICE.

By PARK MORRILL, Forecast Official, in charge of River and Flood Service.

The *extreme and average stages of water* in the rivers for the current month are given in Table VIII. Flood waters have occurred only in the rivers of Oregon. Moderate rises took place in the California streams, and similar rises were caused by the heavy rains which fell in the Appalachian Mountain regions at intervals during the month. The northern Mississippi and Missouri and smaller tributary streams in the Dakotas, Minnesota, Wisconsin, and Iowa are frozen. The following résumé of river stages and conditions of navigation in the various streams is compiled from the reports of the various section directors of the River and Flood Service:

Hudson River.—The local storms on the upper Hudson watershed during the 6th, caused a 10-foot rise in the river at Troy, and an 8-foot rise at Albany. No damage was caused by high water during the month. The amount of water flowing into the Hudson was below the normal for the month of November, but the storm tides due to the passage of storms along the coast, together with the large percentage of southerly winds, which retarded the flow, kept the volume of water in the river from Coxsackie to Troy about normal.

Susquehanna River and Branches.—The general rains on the 4th and 5th caused a rise in all rivers of the watershed, the greatest rise noted on the West Branch being 5.5 feet at Williamsport, where the highest stage recorded was 7.5 feet on the 6th, and 6.0 feet at East Bloomsburg, on the North Branch, where the highest stage was 7.0 feet on the 6th; at Harrisburg the river rose 5.4 feet on the 6th and 2.9 on the 7th, the highest water reached being 10.1 feet on the 7th. Along the Juniata the rainfall on the 4th to 6th averaged between 2 and 3 inches, causing a rise of 2.4 feet at Huntingdon and 8.8 feet at Mifflin. After the 7th the streams fell gradually until near the end of the month, when they rose slowly in consequence of the showers that fell in the drainage basin of the Susquehanna. The water at no time during the month approached the danger line. The culm which came down with the rise on the 6th and 7th, as usual in such cases, discolored the Susquehanna and caused considerable annoyance to consumers of river water.

Rivers of the South Atlantic States.—These streams have been moderately low throughout the month, although a slight rise was occasioned by the rains of the 5th. On the 29th, rain, varying in amount from 0.50 to 1.50 inches, fell in the great valley and middle district of Virginia, and slightly less in eastern Virginia. A rapid, though moderate, rise in the James took place, but at no time caused any apprehension. The ground was very dry, owing to the previous lack of moisture, and a large portion of the precipitation was absorbed by the earth; hence the quantity reaching the river was materially lessened.

The Cape Fear River remained low during the month, except that a rise of 10 to 15 feet occurred on the 6th and 7th, but this did not bring the stage of the river more than half way to the danger line. For the remainder of the month the rivers in eastern North Carolina were quite low. In the mountainous western sections, owing to heavy rains, the streams maintained relatively high stages, except during the latter part of the month.

The logging interests in South Carolina have suffered during the month of November, owing to the unprecedentedly low stages of water in the streams. The Wateree was navigable from the 5th to the 14th only, when a number of rafts were successfully floated downstream. The rise also proved highly beneficial to the steamboat interests, much cotton, tar, rosin, turpentine, and general merchandise being carried down. The Pedee was navigable from the 6th to the 10th between Georgetown and Cheraw. A large amount of merchandise is now awaiting transportation from Cheraw and points below for lack of a sufficient rise. The Santee was navigable from the 8th to the 22d. The Waccamaw and its branches were navigable from the 5th to the 13th from Georgetown to Effingham, Fair Bluff, and Conway, and, therefore, afforded steamboatmen and lumbermen a fair season for transportation. The Edisto was at a very low stage, and navigation thereon was suspended nearly the entire month, and no logging or steamboating was done at all, although millions of feet of lumber and much merchandise are awaiting transportation. A result of the deficient rainfall in the Piedmont region is the substitution by the owners of the cotton mills in those sections, of steam power for the hitherto unfailing water supply. This lack of water is the first occurrence of this sort in twenty-four years. Quite a number of mills have ceased operations entirely for the want of power.

No very noticeable change occurred in the condition of the Savannah River, excepting on two occasions, when a considerable rise took place. The first rise occurred on the 6th, bringing the river up to 20.9 feet at Augusta, and, while facilitating the running of boats between that point and Savannah, was also highly beneficial to the farming interests of the lowlands, by leaving a deposit or sediment over the soil at a time when the fields are not in cultivation. The next rise occurred on the 14th, when the river reached a stage of 13.4 feet at Augusta, and materially aided flat boat traffic in handling produce and cotton. The lowest stage during the month was recorded on the 1st (5.0 feet at Augusta), which at this season of the year is hardly sufficient for rapid navigation, as large shipments of cotton are scattered along the river course for at least 75 miles below Augusta to be conveyed by boat to that market.

Several heavy rains fell on the Georgia watersheds which drain into the Altamaha and Apalachicola rivers. Resultant rises of from 5 to 10 feet were experienced at the various river stations on these streams. The stages were far below the danger line throughout the month.

Mobile River and Branches.—The Tombigbee River and its tributaries have been unusually low, remaining, for the most part, below the zero of the gauges; at Demopolis, on the Tombigbee, the stage did not rise above zero throughout the month. The rain, which was light and scattered, did but little to improve the prevailing unfavorable conditions. The rivers fell generally during the latter part of the month, giving unusually low stages, almost suspending traffic. General rain on the last three days of the month was of vast benefit in relieving this condition, and the rivers rose rapidly, opening navigation to all points, and this has continued to the end of the month. River men report that since May 1 no boat has been above Demopolis, and for the past three months not above Gays Landing, 60 miles below Demopolis. The rivers have been lower this year than for the three seasons past.

The Alabama and tributaries were all low during the first half of the month, with slight increase of water to navigable stages during the latter portion. At Montgomery the extremes varied from 0.5 feet below zero on the 3d to 7.5 feet above on the 14th, the fluctuations being slightly greater at Selma and less at upper river stations. The water has been too low for regular steamer navigation above Selma since the latter part of July. The first boat to arrive at Montgomery since the low season was the steamer *Tinsie Moore* from Mobile on November 19, which carried down over 1,000 bales of cotton and general freight.

Ohio River and Branches.—At Pittsburg the month has been one of exceptional activity for the river interests. For the first time in four years the river has remained open for packet navigation during the entire month. There was a barge-water stage on the 7th and 8th, and

for the entire week beginning with the 24th, culminating in a coal-boat stage on the 30th, on which 35,000,000 bushels of coal were shipped to lower river ports.

At Cincinnati the month closed with a good rise, which made the fourth during the fall, when ordinarily there is but one rise looked for—at about Thanksgiving. River business has therefore been good, and the supply of coal in the market, still abundant, has been augmented by a run of 7,000,000 bushels on the last rise.

At Cairo the river rose slowly from the 2d to the 10th; then fell slowly until the morning of the 14th; rose quite rapidly during the 15th and 16th and continued rising until the morning of the 19th, after which it fell slowly until the 26th; and then rose rapidly until the close of the month. The highest stage was, 14.3 feet, on the 30th; the lowest, 7.6, on the 1st and 2d.

Heavy rains fell on the Tennessee and Cumberland watersheds at the middle of the month. The Tennessee was higher during the present month than it has been any November since 1889, and with more days of navigable water than any year since 1890. Navigation opened on the 7th, closed on the 22d, and opened again on the 29th. Light drift was reported at Chattanooga on the 13th, 14th, 15th, and 29th.

Mississippi River and Minor Branches.—The river stages for the section of river above Davenport were about normal throughout the month, and no marked changes occurred, except at some of the northern stations during the last two or three days of the month, and these were caused by ice gorges. Navigation is reported by the steamboatmen and pilots as very good for this season of the year, though during the month of November very few boats are running on the upper Mississippi River. During this month work generally ceases on the river; the United States Engineers, in charge of the upper Mississippi River improvement, suspended operations about the 15th this year. The river remained open as far north as Dubuque during the entire month, although navigation practically closed to this point on the 21st, and no boats, except ferries, were in operation after that date. Considerable running ice was present between Davenport and Dubuque during the last two or three days of the month. The river closed with ice at North McGregor on the 28th; it closed at La Crosse on the 21st, but opened again on the 26th, closing again on the 30th. It was frozen over at St. Paul on the 28th.

An ice gorge of great extent and doing a vast amount of damage, formed during Friday night, November 27, about 10 miles below Lake Pepin. The gorge formed very rapidly, and by 5 o'clock the next morning had extended as far north as the mouth of the Chippewa River. During Friday night the temperature fell very rapidly, and Saturday morning (28th) was below zero. This severe cold froze the gorge tight, and it continued to form up the Mississippi River into Lake Pepin and also up the Chippewa River; and by Saturday night it had extended 8 miles up the latter river.

The gorge caused a rapid rise in the rivers, the change at Reeds Landing between the 27th and 30th being 5 feet, and the water soon spread out over the bottom lands on the Wisconsin side of the Mississippi, doing great damage to property. As far as could be learned no human lives were lost, but the loss of property and stock is very large, although at present no definite estimate of the money value can be made.

The formation of the gorge is supposed to have been caused by the driving of piles in the Mississippi River at a point a few miles above Alma, Wis., to hold a "sheer boom" for the purpose of running the logs which had been loosened from the sandbars and shores of the Chippewa and Mississippi rivers by the recent heavy rains into the Zumbra River for safe harbor. The river being full of floating logs and ice, the sudden fall in temperature made a gorge of unusual strength. The gorges which created the trouble at Chippewa Falls and Eau Claire, Wis., concerning which the newspapers gave full information, formed further up the Chippewa River and were occasioned by similar causes. The one at Chippewa Falls was at one time 5 miles in length and from 30 to 50 feet in thickness.

The section of river from Davenport to St. Louis disclosed no features of special interest during the month of November. A good boating stage of water has been maintained below the mouth of the Missouri, allowing navigation to proceed uninterruptedly, an occurrence which of recent years has not been frequent at this season. Navigation above St. Louis has been practically suspended, but will continue below indefinitely. Running ice was reported at Warsaw, Ill., on the 28th, and by the 30th the river at that place was bank-full. On the latter date ice commenced to run past Quincy and Hannibal, but as yet none has come out of the Missouri, nor has any been seen at St. Louis except a little shore ice.

From St. Louis to Memphis the river remained at a nearly stationary low stage. During the first week of the month the river gauge at Memphis showed less than 3 feet, but after the 8th a steady rise occurred, advancing the river to a good stage, which was maintained till the close of the month. Navigation on the Mississippi continued through the month without interruption, large packets and coal barges making regular trips to all points. On the small tributarities navigation was suspended for a time on account of low water, but was resumed towards the end of the month and boats now make regular trips up the St. Francis and Hatchie rivers. No ice has so far been seen in this section.

In the section of river from Memphis to Vicksburg the stages were about the average for this season of the year, there being no unusually high or low water to report. The Yazoo River was closed to navigation from the Mississippi the greater part of the month on account of the sandbar which forms at its mouth during low water, but was open at the close of the month owing to heavy rains and rising water in its tributaries and the Mississippi. The work of turning the course of the Yazoo southward to avoid the sandbar now at its mouth, and allowing it to pass in front of Vicksburg, which is cut off from the river during low water, is progressing rapidly, but will require some time for its completion.

The month opened with a moderately low stage in the Mississippi River, from Vicksburg southward, continuing nearly stationary until the middle of the month, when a general rise commenced below Vicksburg and continued until the close of the month, giving a maximum stage some 5.5 feet higher at the close than at the commencement. The stage from New Orleans south was but slightly affected, the river varying less than 2 feet during the entire month at New Orleans.

The usual low November stage was maintained in the Red River, the only rise worthy of mention occurring near the close of the month at Fulton, amounting to about 9 feet between the 26th and 30th. A low stage continued in the Ouachita River until the 27th, when a marked rise occurred, owing to general rains, the stage at Camden showing a rise of about 12 feet between the 27th and 30th, and that at Monroe a rise of over 10 feet. Navigation continued uninterruptedly in the lower Mississippi River, but the low stages in the Red and Ouachita permitted of only light traffic.

Missouri River.—The condition of the Missouri River was marked by few changes during the month. The stream was frozen over at Sioux City on the 28th, and navigation was closed, at and above that point, on that date. On and after the 13th running ice was noted at Omaha, Plattsburg, and St. Joseph. Shore ice formed on sandbars at Omaha on the 29th, and on the morning of the 30th the river was nearly frozen over, there being open water only in the channel. Navigation closed at Omaha on the 30th. At the close of the month the river was open from Crescent City, Iowa, 6 miles south of Omaha, southward.

Arkansas River.—During the greater part of the month the Arkansas River was too low for navigation, but a rise of about 2 feet on the 5th gave sufficient water for navigation up to the 13th; then it declined steadily until the 27th, when another slight rise caused by heavy rains in Oklahoma and the Indian Territory gave sufficient water from the 29th to the end of the month, but with a declining river at the close of the month. No ice or floods were reported during the month. The low stage of the river was favorable for the construction of a bridge that is in course of erection at Little Rock.

Rivers of the Pacific Coast.—On November 19, 1896, the Willamette River was higher at Portland than was ever known before during the month of November, the stage being 20.2 feet. The usual stage during the month of November is from 2 to 6 feet. From the 14th, when the river began to rise rapidly, to the 21st, when the fall began, merchants having goods on docks and in cellars moved their goods therefrom. The freshet in the Willamette was caused by the unprecedented rainfall which prevailed during the first sixteen days of the month. Snow had fallen in the foot hills of the Cascades, which was melted by the chinook which prevailed from the 11th to the 14th, and the melting snow added much to the volume of the flood. Then, too, the rainfall was heavy in the Columbia River Valley and caused the Columbia to rise materially, which prevented the Willamette discharging as much or as rapidly as it otherwise would have done. When it is considered that the average rainfall for November is less than that which fell during the seven days immediately preceding the great rise, the cause of the flood is easily understood. During the freshet the drift was so great as to cause navigation to cease. The river rose sufficiently high in the low places in the Willamette Valley to prevent the Southern Pacific Railroad from running trains. County bridges and a few small railroad bridges were washed out and some stock was drowned. A cool period began on the 16th which checked the river and it then began to fall. The temperature fell on the 29th lower than it had ever been known in November before, causing the Columbia to freeze above the Cascade Locks, and the Willamette also froze above its mouth so as to stop all navigation. Vancouver, Wash., was entirely cut off from November 29 to December 3 on account of the ice. Steamers and other vessels had difficulty in getting up the Columbia from Astoria from November 29 to December 4 on account of floating ice.

During the first decade of the month both the Sacramento and San Joaquin rivers were rather low, and navigation on the former river, while not interrupted, was conducted with reference to the tides. There was little rain in the river basins before November 9. During the second decade the stages were several feet above low water. The third decade was marked by heavy rains and rapid rises in the rivers. At Red Bluff, owing to a break in the levee and sudden change in the

course of the Sacramento, the hatchery of the United States Fish Commission was completely washed out. On the evening of the 25th the river reached its highest, but was still several feet below the danger line. The Yolo and other low basins along the Sacramento were generally under water.

ICE AT THE CLOSE OF THE MONTH.

The following reports from regular stations reporting to the Climate and Crop Service show the thickness of the ice at the close of the month in rivers and harbors:

Iowa.—Sioux City, 10 inches; Keokuk, 0.3. *Minnesota.*—Moorhead, 14. *Missouri.*—Kansas City, 3.8. *Montana.*—Miles City, 6.2. *North Dakota.*—Bismarck, 7.0. *South Dakota.*—Pierre, 11.5. *Wisconsin.*—La Crosse, 3.0.

The following additional reports are from the November Weather Map of the Meteorological Service of the Dominion of Canada:

Esquimault, B. C., ice 2 inches thick, an unusual occurrence at such an early date; Swift Current, 14.0 inches; Port Arthur, 2.0.

TABLE VIII.—*Heights of rivers above zero of gauge, November, 1896.*

Stations.	Distance to mouth of river.	Danger-line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn.[a]	1,934	14	3.7	23	1.5	21	2.5	2.2
Reeds Landing, Minn.	1,864	12	6.5	30	1.1	1,25	2.4	5.4
La Crosse, Wis.	1,799	10	4.1	10	1.9	30	3.3	2.2
North McGregor, Iowa	1,739	18	4.0	13	1.8	1	2.9	2.2
Dubuque, Iowa	1,679	15	3.9	13	1.7	1	3.0	2.2
Leclaire, Iowa	1,589	10	2.2	13-16	0.8	3,4	1.5	1.4
Davenport, Iowa	1,573	15	3.5	17	2.0	3	2.8	1.5
Keokuk, Iowa	1,443	14	3.0	17-20	1.3	30	2.5	1.7
Hannibal, Mo	1,382	17	3.8	4	2.3	1	3.0	1.5
Grafton, Ill	1,284	23	7.5	20,21	2.8	1	5.8	4.7
St. Louis, Mo	1,241	30	9.3	7	4.4	1	6.7	4.9
Chester, Ill.	1,170	30	5.8	8	2.0	1	4.0	3.8
Cairo, Ill	1,073	40	14.3	30	7.6	1	10.7	6.7
Memphis, Tenn	843	33	6.7	23	2.5	3-5	4.6	4.2
Helena, Ark	767	37	10.4	23,24	4.7	5	7.5	5.7
Arkansas City, Ark.	635	42	10.4	26,27,29,30	4.2	1	7.2	6.2
Greenville, Miss	595	40	8.3	29,30	3.7	1,2,7	5.8	6.6
Vicksburg, Miss	474	41	7.5	30	1.7	3	4.0	5.8
New Orleans, La	108	13	4.6	27	3.2	18	3.7	1.4
Arkansas River.								
Fort Smith, Ark	345	22	8.8	30	1.8	23-25	3.7	7.0
Dardanelle, Ark	250	21	5.7	5	1.2	25,26	2.6	4.5
Little Rock, Ark.	170	23	6.7	8	3.1	25,26	4.3	3.6
White River.								
Newport, Ark	150	21	2.8	7	1.0	26	1.6	1.8
Illinois River.								
Peoria, Ill.	135	14	8.1	19,20	5.9	1-4	7.1	2.2
Missouri River.								
Bismarck, N. Dak.[b]	1,201	14						
Pierre, S. Dak.[c]	1,006	14	1.9	8	0.3	15	1.3	1.6
Sioux City, Iowa[d]	676	19	5.3	1	4.8	7-8		0.5
Kansas City, Mo.	280	21	9.4	3	4.7	30	6.9	4.7
Boonville, Mo.	191	20	9.8	4	5.2	26,27	6.9	4.6
Hermann, Mo	95	21	5.0	6	0.1	28	2.0	4.9
Ohio River.								
Pittsburg, Pa	966	22	10.9	30	3.5	21,22	5.5	7.4
Davis Island Dam, Pa.	960	25	11.3	30	4.0	4	6.6	7.3
Wheeling, W. Va.	875	36	11.7	30	4.8	5,6	7.2	6.9
Marietta, Ohio.	795	25	13.8	29	5.2	3	7.7	8.6
Parkersburg, W. Va.	785	38	15.2	29	6.0	4	8.5	9.2
Point Pleasant, W. Va.	708	36	20.5	30	4.2	5	8.2	16.3
Catlettsburg, Ky.	651	50	26.5	30	5.5	6	10.7	21.0
Portsmouth, Ohio	612	50	26.5	30	7.6	5-6	11.9	18.9
Cincinnati, Ohio.	499	45	21.4	30	9.7	8	13.8	11.7
Louisville, Ky.	367	24	9.0	29,30	6.0	9,26,27	7.0	3.0
Evansville, Ind	184	30	15.9	30	6.7	11	9.2	9.2
Paducah, Ky.	47	40	11.8	30	4.1	10	6.4	7.7
Alleghany River.								
Warren, Pa	177	7	3.1	28,29	0.4	3-7	1.3	2.7
Oil City, Pa	123	13	3.9	29	1.2	5,7-9,11	2.2	2.7
Parker, Pa.	73	20	4.7	30	0.7	4	2.3	4.0

TABLE VIII.—*Heights of rivers above zero of gauge*—Continued.

Stations.	Distance to mouth of river.	Danger-line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Alleghany River—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet*
Freeport, Pa.	26	20	8.4	30	2.6	4	4.8	5.8
Conemaugh River.								
Johnstown, Pa	64	7	2.6	6	1.0	2-4	1.8	1.6
Red Bank Creek.								
Brookville, Pa.	35	8	1.7	28	0.2	2-4	0.9	1.5
Beaver River.								
Ellwood Junction, Pa.	10	14	3.0	29,30	1.8	1-5,9-11	2.0	1.2
Big Sandy River.								
Louisa, Ky.	26	20	18.5	29	3.4	3,4	5.4	15.1
Cumberland River.								
Burnside, Ky	434	50	35.0	29	2.1	22	4.4	32.9
Nashville, Tenn	175	40	28.8	30	0.7	7	3.7	28.1
Great Kanawha River.								
Charleston, W. Va.	61	30	13.8	7	4.8	{3,4,13,22,23}	6.0	9.0
New River.								
Hinton, W. Va.	95	14	8.5	6	1.2	1-3	2.4	7.3
Licking River.								
Falmouth, Ky	30	25	8.0	29	1.0	1-3	2.4	7.0
Miami River.								
Dayton, Ohio	69	18	3.3	29	1.6	{4,9,10,19-21}	1.9	1.7
Monongahela River.								
Weston, W. Va.	161	18	6.0	29	−0.2	20,21	0.8	6.2
Fairmont, W. Va.	119	25	8.5	30	1.0	3,4	2.7	7.5
Morgantown, W. Va.	95	20	13.9	30	7.2	5	8.5	6.7
Greensboro, Pa.	81	18	13.0	30	7.5	4,5	8.8	5.5
Lock No. 4, Pa.	40	28	16.7	30	7.0	3-5	8.9	9.7
Cheat River.								
Rowlesburg, W. Va.	36	14	7.0	6	2.0	3,4	3.3	5.0
Youghiogheny River.								
Confluence, Pa.	59	10	6.0	6	1.3	3	2.5	4.7
West Newton, Pa.	15	23	6.7	6	0.5	27	1.9	6.2
Tennessee River.								
Chattanooga, Tenn.	430	33	9.4	30	1.2	1,2	3.5	8.2
Bridgeport, Ala	390	.. ...	6.1	30	0.2	2,3	1.9	5.9
Florence, Ala.	220	16	5.7	30	0.1	1,2,3	1.8	5.6
Johnsonville, Tenn.	94	21	8.8	30	0.3	1-7	2.8	8.5
Wabash River.								
Terre Haute, Ind.	165	16	4.9	15	0.8	3,4	2.9	4.1
Mt. Carmel, Ill.	50	15	8.8	30	2.4	4,5	4.5	6.4
Red River								
Arthur City, Tex.	688	27	11.6	28	2.4	1-3	3.9	9.2
Fulton, Ark	565	28	9.8	30	0.4	1	2.5	9.4
Shreveport, La.	449	29	− 0.3	15,16	− 2.7	1,3,4	−1.7	2.4
Alexandria, La.	139	33	0.6	8-17,30	− 0.1	1	0.4	0.7
Atchafalaya River.								
Melville, La.	100*	31	8.0	28	5.5	12	6.4	2.5
Ouachita River.								
Camden, Ark.	340	39	15.9	30	3.8	25,26	5.2	12.1
Monroe, La.	100	40	12.7	30	1.7	21-26	3.3	11.0
Yazoo River.								
Yazoo City, Miss.	80	25	− 1.0	29,30	− 1.9	16-20	−1.6	0.9
Cape Fear River.								
Fayetteville, N. C.	100	38	19.0	7	2.5	1	5.2	16.5
Congaree River.								
Columbia, S. C.	37	15	11.2	7	0.9	20	2.8	10.3
James River.								
Lynchburg, Va.	257	18	7.4	6	0.2	1-4	17.7	7.2
Alabama River.								
Montgomery, Ala.	265	35	7.5	14	− 0.5	3	2.1	8.0
Coosa River.								
Rome, Ga	225	30	8.4	14	0.5	1-3	2.2	7.9
Tombigbee River.								
Columbus, Miss.	285	33	− 0.2	29	− 2.7	2	−1.9	2.5
Demopolis, Ala.	155	35	− 0.4	30	− 2.1	1	−1.4	1.7
Black Warrior River.								
Tuscaloosa, Ala.	90	38	1.0	30	− 0.8	1,2	0.0	1.8
Savannah River.								
Augusta, Ga	130	32	20.9	6	5.2	4	8.1	15.7
Susquehanna River.								
Harrisburg, Pa.	70	17	10.1	7	1.8	3-5	3.7	8.3
W. Br. of Susquehanna.								
Williamsport, Pa.	35	20	6.9	7	2.1	4	3.5	4.8
Sacramento River.								
Redbluff, Cal	241	23	12.5	24	0.4	8	2.7	12.1
Sacramento, Cal.	70	28	19.0	24	8.8	8,9	11.6	10.2
Willamette River.								
Albany, Oreg.	99	20	29.0	17	2.5	1	10.6	26.5
Portland, Oreg.	10	15	20.2	19	2.0	1,2	9.1	18.2

* Distance to the Gulf of Mexico. [a] Frozen after the 28th. [b] Frozen after the 7th.
[c] Frozen after the 19th. [d] Frozen after the 9th.

SPECIAL CONTRIBUTIONS.

AN ENDEAVOR TO DISCOVER ELECTRODYNAMIC RADIATIONS FROM THE SUN.

By Prof. JOHN TROWBRIDGE, Director of the Jefferson Physical Laboratory, Cambridge, Mass.

J. Wilsing and J. Scheiner, of the Astrophysical Observatory at Potsdam, give in the *Astronomische Nachrichten*, Band 142, No. 3386, a review of the various ways of detecting electrical waves, and conclude by a short description of the method they have adopted to detect electro-dynamic radiations from the sun. Passing over the elementary account of the various forms of Hertz oscillators, in which, by the way, Lebedew's apparatus for obtaining short electric waves is described without reference to Rhigi's earlier work in the same direction, we come to the form of apparatus which the authors used. It consists essentially of a Wheatstone's bridge with variable contacts, the resistance of which is modified by electrical oscillations. This form of apparatus has been used by various investigators, especially by Lodge. In the hands of Wilsing and Scheiner it was competent to show the existence of electrical oscillations arising from a source many feet distant. Notwithstanding the effects of direct heat radiations were excluded, and also the disturbing effect of vibrations, no deflections were observed which could be attributed to electro-dynamic radiations from the sun. It is doubtful if such radiations can be detected by the arrangement adopted by the authors, unless it is made extraordinarily sensitive. In this condition it would be affected by slight jars and mechanical vibrations. One should repair to an isolated mountain peak to carry out such experiments.

SUNSTROKE WEATHER OF AUGUST, 1896.

By W. F. R. PHILLIPS, M. D., in charge of the Section of Climatology.

The abnormal heat that prevailed over the eastern two-thirds of the United States during the last few days of July, and the first twelve days of August, 1896, suggested to the Chief of the Weather Bureau, the propriety of studying the subject of sunstrokes, in so far as it is connected with and dependent upon meteorologic conditions.

With this object in view he directed that the following circular, asking for information, be sent to different hospitals located in the affected region, and also to others from whom useful information might be secured.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU,
Washington, D. C., August 20, 1896.

The large number of casualties reported by the newspaper press as attributed directly to the effects of the recent hot spell of weather that prevailed extensively over the country, especially the eastern part, has suggested to the Weather Bureau the propriety of studying the subject of sunstroke in so far as it is connected with and dependent upon the meteorologic conditions, in order that the weather forecasts issued by the Bureau may, if possible, be given an additional general value.

With this object in view, the Bureau would request those into whose hands this circular may come to give the information, if any, in their possession, provided for in the subjoined blank as completely as practicable, and to return the same in the addressed franked envelope, herewith inclosed.

Should the results of the contemplated investigation be deemed of sufficient value, they will be published for public distribution.

WILLIS L. MOORE,
Chief of Bureau, and Acting Secretary of Agriculture.

The information obtained seemed to be of such importance that he gave specific instructions to the writer to make compilation and study of the same, with the result as herein stated.

In this paper and the accompanying statistical tables the term sunstroke is used to include a variety of morbid conditions, in accordance with the general practice of physicians, as defined by the following quotation from the article on "Sunstroke," contributed by Sir Joseph Fayrer, to the work entitled A System of Medicine, edited by T. C. Allbutt:

Under the designation sunstroke, heat stroke, insolation, etc., a variety of morbid conditions, from the simplest to the gravest, are included. However these conditions may be modified by personal susceptibility, local surroundings, and climatic influences, they are essentially due to heat and are the result of direct exposure to the rays of the sun or to a high atmospheric temperature in the shade.

To those unacquainted with medical affairs it may be stated that the general inclination among pathologists is to consider excessive atmospheric heat, natural or artificial, as the chief extrinsic factor in the causation of sunstroke, using the term as above defined. As to the relative importance of the other atmospheric conditions, they are regarded as auxiliaries that may be more efficient at one time than at another, depending upon the physical state of the individual. The particular degree of heat that can be endured without injury or that may be required to produce sunstroke has not been definitely established. Both will depend upon contingencies, which will be mentioned further on.

It is generally accepted that the injurious action of heat is primarily exerted upon the nervous system to disarrange, in one way or another, the complex and nice adjustments existing between the physiologic processes concerned in the production of heat and the loss of heat. The manifestations of the morbid effects of heat, as seen in sunstroke, may be broadly divided into two categories. In one there is a fall of the temperature of the body below its normal; the skin is pale and cool and covered, more or less, with a clammy perspiration. This is the general class—heat exhaustion or prostration. The other class is characterized by a rise in the temperature of the body above the normal to a state of fever; the skin is usually red, hot, and dry. This is the general condition to which some writers would alone restrict the term sunstroke; it is probably best described as thermic or heat fever. Between these two categories there is no hard and fast line of demarcation, and cases may be seen which present some of the characteristics of each class, or which primarily falling in one category subsequently pass over to the other.

In connection with the following statistics of sunstroke cases and mortality, it should be stated that every effort has been made to avoid duplication of facts, and it is believed that whatever errors, if any, have crept in through this avenue they are too small to vitiate the general result. Perhaps the most serious source of doubt will be found subsisting in the matter of diagnosis; but possible error of diagnosis is a defect inherent to all statistics dealing with disease, and which can not be avoided in the present case any more than in the great number of other cases where statistics are invoked to throw light upon the relation of health to environment.

It must be borne in mind that the meteorologic data, though determined by instruments of precision can not be assumed to represent all the variations of the weather to which the human being may be subjected in the course of the day, even though both may be in the same neighborhood, because meteorologic instruments are exposed under fixed conditions, whereas man is continually changing his local surroundings, and with each change either of place or occupation, he alters more or less his meteorologic environment and its effects upon him. It is this difference in the circumstances of exposure that renders it impracticable to state

precisely by means of ordinary meteorologic records the atmospheric conditions actually experienced by the living being. The consideration of this, as well as other matters of a *more* purely physiologic nature, should prepare the reader not to expect to find any attempt made in this paper to give minute details as to the relation between sunstroke and weather.

From such sources as were accessible to the writer there have been collected 2,038 instances of death during August, 1896, directly attributed to sunstroke. This large number of fatal cases was collected as follows: 1,817 deaths reported by health officials of the cities named in Table 1; 207 from newspaper notices and not included in the foregoing; 14 from special reports. Large as this number is it must fall far short of the actual number of victims.

TABLE 1.—*Showing the number of deaths from sunstroke during August, 1896, as reported by the health officials of certain cities.*

Place.	Week ended August—				Month.
	8	15	22	29	
Boston, Mass.	0	64	2	2	66
New York, N. Y.	11	648	66	1	726
Brooklyn, N. Y.	5	215	99	0	319
Philadelphia, Pa	6	173	39	0	218
Baltimore, Md	12	78	7	1	98
Washington, D. C.	7	29	0	0	36
Worcester, Mass	.....	.....	.....	.....	4
Rochester, N. Y.	.....	.....	.....	.....	2
Buffalo, N. Y.	1	1	.....	.....	2
Pittsburg, Pa	2	3	.....	.....	5
Cincinnati, Ohio	.....	10	3	.....	13
Columbus, Ohio	2	.....	.....	.....	2
Chicago, Ill	.....	.....	.....	.....	178
Muskegon, Mich	.....	1	.....	.....	1
Davenport, Iowa	.....	.....	2	.....	2
Keokuk, Iowa	.....	.....	1	.....	1
St. Paul, Minn	1	.....	.....	.....	1
St. Louis, Mo.	.....	.....	.....	.....	122
Chattanooga, Tenn	.....	1	.....	.....	1
New Orleans, La.	3	.....	6	.....	9
Phœnix, Ariz.	.....	1	.....	.....	1
Total	50	1,224	225	2	1,817
Add newspapers	.....	.....	.....	.....	207
Add special reports	.....	.....	.....	.....	14
Total	.....	.....	.....	.....	2,038

The number of cases of sunstroke that did not end fatally must have been something enormous, but only a limited attempt was made to collect statistics of this class, owing to the difficulty of getting satisfactory data. From information so far received, there have been collected 841 cases of sunstroke treated either in hospitals or in private practice of physicians (see Table 2). Of these 841 cases it appears that 140, or 16.6 per cent, terminated fatally. If this mortality rate be assumed as an idex of the general mortality rate from sunstroke, obtaining, in general, during this epidemic, then the 2,038 fatalities would represent the occurrence of 12,277 cases of sunstroke of varying degrees of severity, and even this may be far below the truth.

Tables 2 and 3 show the number of hospital cases and of deaths due to sunstroke on each day. It will be seen from these tables that by far the greater part both of hospital cases and of deaths from sunstroke happened upon the 9th, 10th, 11th, 12th, and 13th of August, and in the region indicated in the first paragraph of this paper. The period from August 9 to 13 may, therefore, be regarded as having been in that region particularly favorable for the operation of the causes producing sunstroke, and it may perhaps be admissible to speak of the weather during that period as being "sunstroke weather." More than 75 per cent of the hospital cases were admitted during August 9–13, and more than 80 per cent of the sunstroke mortality that could be located by weekly periods occurred during the week August 9–15.

For convenience of reference the region already indicated of maximum number of recorded cases of sunstroke may be subdivided into a coastal region and an interior region, the area included in each will be sufficiently indicated by the stations selected to represent it, as shown in Tables 2, 3, and 4. These tables show that a few sunstrokes occurred in the interior region on August 3 and in the coastal region on August 4, but that it was not until three or four days later that the number in either region began to assume portentous proportions. The last cases may be virtually said to have occurred on August 15. The weather during the interval, August 3–15, was characterized by intense heat, which became evident in the interior region on the 4th and in the coastal region on the 5th. In both regions the temperature rose from 3° or 4° to 10° or 13° above the normal during the hottest part of the period, which was from the 8th to the 10th in the interior, and from the 9th to the 12th on the coast; it then fell during the following two days in both regions to about the normal. In both regions the absolute atmospheric humidity was considerably above the average and varied with the temperature, though less rapidly. On the other hand, the relative humidity was subject to frequent fluctuations both above and below the average. The atmospheric pressure was above the average during the entire period. There does not appear to have been anything characteristic about the winds, or the clearness of the atmosphere from what is usual during protracted spells of fair and somewhat rainless weather.

Attention has been called to the interval from August 9 to 12 as the special period of sunstroke occurrence, and as being what the writer has ventured to call "sunstroke weather." Taking this period as affording a promising field for studying the causal relations of meteorologic conditions and sunstroke it would appear that: The daily mean temperatures were highest during this period, being from 10° to 13° above the normal in both regions, or, the average temperature for each of these twenty-four hours equaled or exceeded the normal temperature of the hottest hour of an average August day. The absolute humidity was greatest in both regions during these four days, and the relative humidity was above the average in the interior, but considerably below the average in the coastal region. There does not appear to be any other noticeable or characteristic meteorologic feature during this period.

[As the tables of mean temperature and maximum temperature seem to be more important than those of humidity, wind, and rainfall, therefore, these latter are reluctantly omitted from the present publication.—ED.]

From the given tables it must be concluded:

(*a*) That the number of sunstrokes follows more closely the excess of the temperature above the normal (see Tables 5 and 6) than it does that of any other meteorologic condition:

(*b*) That the number of sunstrokes does not appear to sustain any definite relation to the relative humidity, the maximum fatalities having occurred in one region with a relative humidity above the average, and in the other region with a relative humidity decidedly below the average.

(*c*) That although the absolute humidity was greatest during the maximum of sunstrokes, yet it does not appear that the variations influenced the number of cases.

If it be taken into consideration that the maximum quantity of aqueous vapor in a given space is limited by the temperature of the vapor, and that the relative humidity is really not a simple meteorologic element, but an expression of a ratio that depends on both the aqueous vapor and the temperature, it would seem that the statistics herein collected confirm the proposition that sunstroke is ultimately due to excessive atmospheric temperature. In other words, sunstroke will not occur unless the atmospheric temperature be much greater than that to which the individual is accustomed, no matter what may be the state of the other meteorologic elements. The important point to be determined from our statis-

TABLE 2.—*The daily number of cases of sunstroke admitted to certain hospitals or in the practice of certain physicians from August 1 to 20, inclusive, 1896, together with the resulting mortality.*

Place.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total cases.	No. of deaths.	Authority (hospital or physician).
Manchester, N. H											1										1	1	Elliot Hospital.
Albany, N. Y								1		4	5	5									15	3	Albany Hospital.
Rochester, N. Y								2						1	2						5		Homeopathic Hospital.
Boston, Mass										4	8	18	2			1					33	8	Boston City Hospital.
New Haven, Conn										2	2	4	7	3	2						20	2	New Haven Hospital.
New York, N. Y				2	3	9	5	12	15	49	78	106	64	9	5						357	62	Hudson Street, Roosevelt, and New York hospitals.
Brooklyn, N. Y						2	4	8	5	11	26	32	11	2	2						103	22	St. John's, St. Mary's, and Brooklyn hospitals.
New Brunswick, N. J						1			1		3										5	2	Doctors Williamson and Smith.
Philadelphia, Pa					1	9	11	13	8	22	30	34	21	13	2						164	16	St. Agnes, Episcopal, Medico-Chirurgical, and Hahnemann hospitals.
Washington, D. C					1	1	2	3	2	5	1	3	2		1	1					22	7	United States Government Hospital for Insane, Garfield, Providence, and Freedman's hospitals.
Coastal group				2	5	22	22	39	31	97	154	202	107	28	14	2							
Pittsburg, Pa								1				1									2	2	S. S. Hospital.
Cincinnati, Ohio			3	2	2	4	2	8	4	9	7		1	2	3				1		48	5	United States Marine Hospital, St. Mary's and Cincinnati hospitals.
Columbus, Ohio									1						1						2		St. Francis' Hospital.
Cleveland, Ohio									4	4	1										9	2	St. Alexis', St. John's, and Huron Street hospitals.
Detroit, Mich										1	1										2		United States Marine Hospital.
Holland, Mich			1				1														2		Dr. Henry Kremeis.
Chicago, Ill				2	1	1	1	6	3	1	1			2							19	4	St. Luke's, Mercy, and Michael Reese hospitals.
Springfield, Ill					1						1										2		City physician, Wabash Emp. Hospital.
Louisville, Ky			2	1		3	1		2												9		City Hospital.
Cairo, Ill								1													1		Dr. W. F. Grinsted.
Hannibal, Mo				1			3					1									5	1	Drs. R. H. Godin, S. Q. Smith, P. L. Kabler.
Columbia, Mo																				1	1		Dr. W. A. Norris.
Kansas City, Mo						1			2					1							4	1	Drs. W. S. Wheeler, L. A. Berger, C. L. Hall.
Des Moines, Iowa														1							1		Dr. F. L. Wells.
St. Paul, Minn				1					1												2	1	City and County Hospital.
Interior group			6	7	4	9	8	16	17	15	11	2	1	6	5				1	1			
Raleigh, N. C											1										1		Rex Hospital.
Charleston, S. C																		1			1		City Hospital.
Mobile, Ala																				1	1		Dr. J. A. Abrahams.
Dallas, Tex				1				1												1	3		Parkland Hospital.
Palestine, Tex	1																				1	1	Dr. J. M. Colley.
Grand total	1		6	10	9	31	30	56	48	112	166	204	108	34	19	2		1	1	3	841	140	

TABLE 3.—*The daily number of deaths from sunstroke occurring in certain regions between August 1 and 20, inclusive, 1896.*

August, 1896.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Authority.
Coastal group (Massachusetts, Connecticut, Rhode Island, New York, Pennsylvania, Maryland, District of Columbia, and Virginia).					4	11	11	28	107	204	274	264	108	37	5	4		2	1	1	Newspaper clippings, health officers' reports, special reports, physicians and others. (The information from which this table is compiled is far from complete.)
Interior group (Ohio, Kentucky, Tennessee, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, and Oklahoma).		1		5	5	14	16	13	50	100	58	14	3	1		2	1			1	
Total: Coastal and Interior groups		1		5	9	25	27	41	157	304	332	278	111	38	5	6	1	2	1	2	

TABLE 5.—*The mean temperature of each day at certain selected stations during the sunstroke epidemic of August 3 to 18, inclusive, 1896.*

Place.	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Coastal region.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Albany, N. Y	72	78	82	83	82	82	82	84	83	82	77	76	75	74	69	64
Boston, Mass	71	78	72	65	77	75	82	86	82	82	76	71	67	74	72	68
New Haven, Conn	71	77	80	72	77	81	82	84	83	84	82	74	72	73	69	64
New York, N. Y	74	77	80	82	80	82	82	84	85	84	81	75	74	73	68	65
Philadelphia, Pa	77	79	82	86	84	86	87	84	87	87	85	77	79	78	74	71
Washington, D. C	78	80	83	88	87	84	87	84	84	86	82	78	77	79	73	71
Interior region.																
Chicago, Ill	77	82	84	79	77	87	83	86	81	73	72	78	76	72	68	65
St. Louis, Mo	82	86	88	90	91	91	90	84	86	82	79	81	86	77	72	72
Cincinnati, Ohio	78	78	81	85	76	84	85	84	82	78	80	78	82	76	68	70
Southern region.																
Charleston, S. C	84	80	83	82	82	85	87	86	84	82	84	82	80	84	86	80
Jacksonville, Fla	86	84	82	83	84	84	86	86	86	84	85	83	84	84	84	86
New Orleans, La	82	86	86	84	84	81	78	82	82	86	84	82	80	82	85	87
Western region.																
Denver, Colo	77	78	74	71	74	76	76	74	68	72	77	78	76	74	73	71
Los Angeles, Cal	70	70	68	66	70	68	69	68	70	69	71	72	71	74	76	74

tical tables is the atmospheric temperature that will produce sunstroke. Referring again to these tables, it will be observed that, for instance, in the city of Boston a number of people were prostrated and some killed by sunstroke when the mean temperature of the day rose to 82°, or 13° above the August normal; but there were thousands of people living there at the same time that were unhurt by this high temperature as far as can be told; it is, therefore, evident that some people can withstand a higher temperature than others; in other words there is a personal equation to be taken into consideration. Again, it will be seen that while a mean temperature of 82° was fatal or injurious to a large number of people in Boston, yet the same degree of heat is the customary August temperature which the inhabitants of New Orleans endure without sunstroke or any particular inconvenience. Evidently there must enter into the case another factor, namely, the accommodation of the individual to average physical environment, or the climatic equation, and it is apparent therefrom that

TABLE 6.—*The departure of the daily mean temperature from the normal at certain stations from August 3 to 18 inclusive, 1896.*

Place.	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Albany, N. Y	0	+6	+10	+11	+10	+10	+11	+13	+12	+11	+6	+5	+4	+3	−2	−7
Boston, Mass	+1	+8	+2	−5	+7	+5	+13	+17	+13	+13	+7	+2	−2	+5	+3	−1
New Haven, Conn	+1	+7	+10	+2	+7	−11	+13	+15	+14	+15	+13	+5	+3	+4	0	−5
New York, N. Y	+1	+4	+7	+9	+7	+9	+10	+12	+13	+12	+9	+3	+2	+1	−4	−7
Philadelphia, Pa	+3	+4	+6	+10	+10	−11	+11	+8	+12	+12	+10	+3	+5	+4	−1	−2
Washington, D. C	+3	+5	+8	+13	+12	+9	+13	+10	+10	+12	+8	+4	+3	+5	−1	−3
Chicago, Ill	+5	+10	+13	+8	+5	+15	+12	+16	+9	+1	+1	+8	+6	+2	−6	−7
St. Louis, Mo	+4	+9	+11	+12	+13	−13	+12	+5	+8	+4	+1	+3	+8	−1	−6	−6
Cincinnati, Ohio	+2	+2	+5	+9	0	+8	+10	+9	+7	+3	+5	+3	+7	+1	−7	−5
Charleston, S. C	+3	−1	+2	+1	+1	+4	+7	+6	+4	+2	+4	+2	0	+4	+6	0
Jacksonville, Fla	+4	+2	0	+1	+2	+2	+4	+4	+4	+2	+3	+1	+2	+2	+2	+4
New Orleans, La	0	+4	+4	+2	+2	−1	−4	0	0	+4	+2	0	−2	0	+3	+5
Denver, Colo	+5	+6	+3	0	+3	+5	+5	+3	−3	+1	+7	+8	+6	+4	+3	+1
Los Angeles, Cal	−2	−2	−4	−6	−3	−5	−4	−5	−3	−4	−2	−2	−3	0	+3	+1

TABLE 7.—*The departure of the daily maximum temperature from the normal August maximum at certain stations from August 3 to 18, inclusive, 1896.*

Place.	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Normal max.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Boston, Mass	+3	+12	+2	−9	+12	+2	+14	+17	+11	+11	+3	−3	−8	+5	+1	0	78
New York, N. Y	−1	+7	+9	+11	+11	+12	+10	+11	+14	+12	+8	0	−1	−3	−6	−7	80
Philadelphia, Pa	+6	+8	+12	+14	+13	+14	+14	+11	+15	+15	+12	0	+5	+6	−4	−2	82
Washington, D. C	+2	+7	+12	+14	+13	+9	+13	+9	+10	+12	+11	+1	+2	+4	−3	−4	84
Chicago, Ill	+8	+16	+17	+7	+4	+20	+15	+15	+14	−2	−3	+7	+5	−3	−8	−8	78
St. Louis, Mo	+6	+11	+12	+13	+14	+14	+13	+5	+11	+8	+3	+2	+11	−1	−9	−7	86
Cincinnati, Ohio	+2	+5	+8	+12	−2	+10	+10	+9	+9	+1	+4	+2	+6	−2	−7	−6	84
Charleston, S. C	+8	−1	+1	0	+1	+5	+8	+5	+4	+1	+3	+2	0	+2	+6	+3	87
Jacksonville, Fla	+5	+6	+2	0	+2	+2	+5	+5	+6	+3	+4	+5	+3	+2	+3	+6	90
New Orleans, La	+2	+6	+8	+4	+4	0	−1	+2	+2	+6	+5	+1	−3	+2	+5	+7	88

the temperature likely to cause sunstroke varies with the climate of the locality; hence, each particular locality has for its native or acclimated inhabitant a special local sunstroke temperature or range of temperature.

As a provisional index to the "sunstroke temperature" of each climate the author proposes the use of the average or normal maximum daily temperature during the warm season of the year, and as a working hypothesis derived therefrom, submits the following proposition: Sunstroke becomes imminent during the summer months, when the mean temperature of any one day, or of several consecutive days, becomes equal, or nearly equal, to the normal maximum temperature for the same period.

The following tabular statement shows the result of the application of this proposition to several of the large cities in the coastal region. The respective columns show:

1. The number of sunstroke cases admitted into the hospitals of the respective cities from the 3d to 18th of August, inclusive.
2. The normal maximum temperature for August.
3. The consecutive dates on which the mean daily temperature for August, 1896, equaled or exceeded the normal maximum for August.
4. The number of sunstroke cases admitted to hospitals during these consecutive dates.
5. The percentage of the cases admitted on these days relative to the total number of cases between August 3–18, inclusive.

Station.	1	2	3	4	5
		°	*Aug.*		*p. ct.*
Boston	33	78	9-12	30	91
New York	357	80	5-13	341	96
Philadelphia	164	82	5-13	149	91
Washington	22	84	6-12	17	77

In these special cases, therefore, the approach of the mean daily temperature to the normal maximum temperature was an excellent criterion of impending danger, and it remains for accumulated statistics to show how trustworthy this criterion may be in other cases. In the light of the data here presented for August, 1896, the above rule appears to be an empirical one; but it is based on plausible hypotheses, and can be readily applied; especially is it one that adapts itself easily and naturally to every climate, and therefore embodies at least a part of what we have called the climatic equation. As enunciated above, it has the merit of expressing a relation with considerable precision, that may be expressed in other words as follows: The liability to sunstroke increases in proportion as the mean temperature of the day approaches the normal maximum temperature for that day.

In addition to the influence of heat, the statistics furnished by the hospitals and physicians enable us to determine approximately the general influence of personal habits, and of nationality and other peculiarities. For instance, of the 841 cases collected in Table 4, the history of 465 as to the use of alcoholic drinks is given as follows:

Using to excess	140	cases, or	30	per cent.
Using moderately	230	"	50	"
Using not at all	95	"	20	"
Total	465	"	100	"
History unknown	376			
Total	841			

If the 140 deaths that occurred in these 841 cases be similarly classified, the resulting figures are:

Using to excess	41	deaths, or	60	per cent.
Using moderately	22	"	30	"
Using not all	7	"	10	"
Total	70	"	100	"
History unknown	70			
Total	140			

If these facts teach anything it is that the use of alcoholic beverages in hot weather is to be reprobated most strenuously.

Table 4 shows some interesting facts as to the nationalities that contributed to these 841 cases, but it would not be safe to argue much as to the relative liability of any nationality to sunstroke unless we could first compare these numbers

with the general distribution of population by nationalities. One item gathered from the reports, but not shown by this table, is that only 15 of these cases were colored people, and the mortality among them was 2. As to sex, 100 cases were females. So far as occupation was concerned all walks of life were represented, but the greater number of cases occurred among those engaged in occupations apparently requiring physical rather than intellectual effort.

TABLE 4.—*The 841 cases of sunstroke reported from hospitals or private practice, arranged according to nativity and fatality*

Nativity.	Number reported.	Deaths.	Nativity.	Number reported.	Deaths.
United States	340	37	Austria	5	2
Ireland	253	44	Denmark	2	1
Germany	123	24	Belgium	1	1
England	32	5	South America	2	0
Italy	14	0	Spain	1	0
France	10	5	Holland	1	1
Canada	8	3	Australia	1	0
Norway and Sweden	10	5	Armenia	1	0
Russia	7	0	Greece	1	0
Poland	6	0	Unknown	15	12
Scotland	5	0			
Switzerland	3	0	Total	841	140

HOW THE CHINOOK CAME IN 1896.

By A. B. COE, Voluntary Observer (dated Kipp, Mont., December 10, 1896).

Picture to yourself a wild waste of snow, wind beaten and blizzard furrowed until the vast expanse resembles a billowy white sea. The frigid air, blowing half a gale, is filled with needle-like snow and ice crystals which sting the flesh like the bites of poisonous insects, and sift through the finest crevices. The sun, low down in the southern horizon, looks like a frozen globe, with halves, crescents, and bright prismatic bars encircling it.

Great herds of range cattle, which roam at will and thrive on the nutritious grasses indigenous to the northern Slope, wander aimlessly here and there, or more frequently drift with the wind in vain attempts to find food and shelter; moaning in distress from cold and hunger, their noses hung with bloody icicles, their legs galled and bleeding from breaking the hard snow crust as they travel—they appeal to the hardest heart for pity. It is sure death for human beings to be caught out in one of these awful blizzards, with the temperature down to 30° or 50° below zero, unless rescue is speedy. Yet, such conditions frequently exist in this latitude, as they did for fifteen days in November, 1896, when it seemed as if the elements had conspired to bring about another ice age, and annihilate every living thing.

Would the "chinook" never come? The wind veered and backed, now howling as if in derision, and anon becoming calm, as if in contemplation of the desolation on the face of nature, while the poor dumb animals continued their ceaseless tramp, crying with pain and starvation. At last, on December 1, at about the hour of sunset, there was a change which experienced plainsmen interpreted as favorable to the coming of the warm southwest wind. At sunset the temperature was only —13°, the air scarcely in motion, but occasionally seemed to descend from overhead. Over the mountains in the southwest a great bank of black clouds hung, dark and awesome, whose wide expanse was unbroken by line or break; only at the upper edge, the curled and serrated cloud, blown into tatters by wind, was seen to be the advance courier of the long-prayed for "chinook." How eagerly we watched its approach! How we strained our hearing for the first welcome sigh of the gentle breath! But it was not until 11.35 p. m. that the first influence was felt. First, a puff of heat, summer-like in comparison with what had existed for two weeks, and we run to our instrument shelter to observe the temperature. Up goes the mercury, 34° in seven minutes. Now the wind has come with a 25-mile velocity. Now the cattle stop traveling, and with muzzles turned toward the wind, low with satisfaction. Weary with two weeks standing on their feet they lie down in the snow, for they know that their salvation has come; that now their bodies will not freeze to the ground.

The wind increases in strength and warmth; it blows now in one steady roar; the temperature has risen to 38°, the great expanse of snow 30 inches deep on a level is becoming damp and honeycombed by the hot wind, and we retire satisfied that the "chinook" is a genuine and lasting one.

Twelve hours afterward there are bare brown, hills everywhere; the plains are covered with floods of water. In a few days the wind will evaporate the moisture, and the roads will be dry and hard. Were it not for the "chinook" winds the northern Slope country would not be habitable, nor could domestic animals survive the winters.

A METHOD OF FILLING A BAROMETER.

By Prof. EDWARD A. PARTRIDGE, Central Manual Training School, Philadelphia (dated November 12, 1896).

The tube selected for the barometer must be cleaned with the utmost care. This can be effected conveniently before sealing, as follows: After soaking for two hours in nitric acid, the tube is washed thoroughly with water. Then a wire drawing a string after it is passed into the tube. In the middle portion of the string there is a loop carrying a wad of cotton of suitable size. By drawing the string back and forth the cotton is made to wipe off all dirt. The tube is then washed with water, treated for a few minutes with a strong solution of caustic alkali, followed by thorough washing with pure water. A wad of cotton filled with precipitated chalk is next drawn through the tube. The precipitated chalk is preferable to rotten stone, tripoli, emery flour, or similar materials, since it can be entirely removed by subsequent treatment with nitric acid and water. This polishing of the tube is important, as it tends to give a clean surface, which allows the column of mercury to move with freedom in the tube. After the last treatment with nitric acid and subsequent careful washing with distilled water, the tube is set on end to drain, then carefully dried by drawing air (previously passed through sulphuric acid), through it, and at the same time heating it. After sealing the end the tube is arranged as shown in Fig. 1.

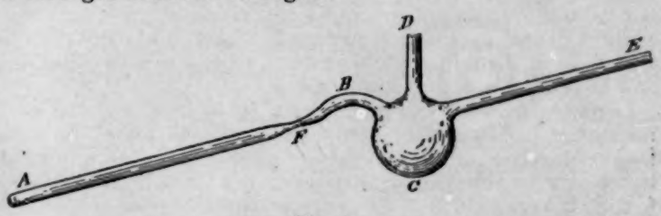


FIG. 1.

A B is the barometer tube, inclined at an angle of about 15°. The inclination should not be made more than 15°, since if it is the mercury acquires considerable velocity in sliding down the tube and will fall into the mercury already there with a splash, thus entangling a very minute portion of air. With the inclination of 15° there is no such splashing. *C* is a light glass retort which can be made by any one moderately skillful at glass blowing. *D* is a tube for introducing the proper amount of mercury to fill *A B*. *E* is a tube hermetically sealed to a mercury air pump, preferably of the Geissler type. *E* should be at least 10 inches long and inclined downward toward the retort in order that the mercury vapor may condense in it and run back to *C* instead of going to the pump. After introducing the mercury the tube *D* is heated with the blowpipe and drawn off and sealed. Between

the connecting tube *E* and the pump a bulb containing phosphoric anhydride must be placed. The whole apparatus, suitably supported, is now completely exhausted by running the pump continuously for hours, occasionally heating the tube *A B* with the flame of a Bunsen burner. *C* should also be heated until mercury vapor is somewhat freely given off to drive out moisture and air. By this method all moisture in the mercury, together with the film of air which obstinately adheres to the inside of the tube, can be as nearly as possible removed. When this has been accomplished, the retort *C* is carefully heated to distill the mercury over into *A B*, where the mercury condenses in small globules, which do not form pistons in the tube, and which run down the lower side of *A B*, thereby displacing any residual air. The distillation is continued until *A B* is filled; the pump is kept in action all the time. By the continuous action of the pump the vacuum is kept as complete as possible during the entire operation. The tube *E* is then cut from the pump to let air into the retort. The barometer tube is cut off at *F* and immersed in mercury with the usual precautions. Tubes that we have filled by this method show not the slightest trace of air when inclined.

The essential feature of the method consists in distilling the mercury into an inclined tube of such an internal diameter that the mercury collects in globules, which run down the lower side of the tube, instead of forming pistons, which would imprison and carry down the residual air, thus rendering the vacuum imperfect. Tubes of internal diameter greater than one-eighth inch are large enough to be filled in this manner. If the bore is less than one-eighth of an inch, the mercury will form pistons and carry down the residual air.

The method is the result of experiments carried out by my father, Mr. D. A. Partridge, and myself.

At first sight the above method seems almost completely identical with that described by Waldo in the American Journal of Science, 1884, Vol. XXVII, p. 18. I do not believe, however, that a good instrument could be made by Waldo's method, since the mercury, when distilled into his vertical tube, would form pistons and carry down air. He says that watch must be kept to see that no air is carried down. I have tried his method with a mercury pump, giving far better vacua than pumps of the form then in use could give, and have always found minute air bubbles entangled in the mercury. I therefore think that my method, if not wholly new, is really an important one and a real advance. Another important difference between my method and that of Waldo is that I keep the pump working during the entire distillation, and he stops his before commencing.

[Further details as to filling large tubes that are to be used for either barometers or manometers will be found in Professor Marvin's articles on vapor pressure and on a normal barometer in the Annual Report of the Chief Signal Officer for 1891, Appendix 10. The admirable barometer of Sundell (*Acta Societatis Scientiarum Fenicæ*, Vols. XV and XVI, Helsingfors, 1885 and 1888) is fully described in Waldo's Modern Meteorology, London and New York, 1893, to which we would refer our readers for many other details as to the advanced state of physical apparatus and mechanical theories that constitute modern meteorology.—ED.]

THE COLD SPELL OF NOVEMBER 16-30, 1896, IN MONTANA AND ADJOINING STATES.

By PROF. H. A. HAZEN (dated December 21, 1896).

A remarkable depression in temperature occurred in the Northwestern States during the last two weeks of November. At Havre, Mont., the culmination was on the 18th, p. m., with a temperature of 54° below normal, though on the 29th, p. m., it was —51°. Not the least singular fact in this connection is the abnormal warmth in the Middle Atlantic States, where for a considerable area the temperature during the same time was 10° above normal. Charts VIII and IX of this REVIEW show the average departure from the normal for each day of these two weeks. A very good idea of the extent and severity of this cold spell may be obtained by comparing it with the coldest November experienced in the past twenty-seven years, that of 1880, as follows:

Stations.	Departure from normal.	
	1880.	1896.
	°	°
Havre, Mont	— 9	—27
Helena, Mont	—11	—15
Miles City, Mont	— 8	—19
Williston, N. Dak	— 7	—22
Bismarck, N. Dak	— 9	—20
Rapid City, S. Dak	—12	—16
Pierre, S. Dak	— 8	—20

The limited extent of the present cold spell may be shown by a comparison with a few stations on its border: Salt Lake City, 1880, —9°, 1896, —2°; Kansas City (Leavenworth), —8° and —3°; Columbia, Mo., 1896, + 2°; Alpena, Mich., —7° and + 2°; Amarillo, Tex. (Fort Elliott), —12 and —3°. Another point to be noted is that while the extreme cold of 1880 extended over the whole country, for example, Vicksburg, —8°, Atlanta, —4°, Charlotte, —5°, Washington, —4°, and Eastport —2°, that of 1896 was limited to a few States in the Northwest, whereas in the Middle Atlantic States, November, 1896, was the warmest since 1870, and at Philadelphia it was the warmest in seventy-five years (records before 1870 a little doubtful, stations in the city differing 2° or 3° in the same month).

A study of the weather conditions accompanying such marked anomalies in temperature would be of interest in helping to explain them. As already noted there was a permanent area of high pressure over the Northwest during this period, departure from normal + .50 inch at Havre and + .43 inch at Bismarck. This could not have been due to a too great reduction to sea level because of the low temperature, for Bismarck is only 1,690 feet above sea level, and the change for temperature is small at that height.

This distribution of pressure produced northwesterly and westerly winds in the Missouri and upper Mississippi valleys, but in the middle and lower Mississippi valleys to the Atlantic the winds were southeasterly, southerly, and southwesterly. On the south Atlantic Coast, northeasterly winds from the ocean tended to keep the temperature up. Comparing the pressure distribution with that of 1880, we find in the latter year high pressures over the whole country, and in consequence the winds mostly north and northwest, except in a portion of the lower Lake Region, where they tend toward southwest. It is evident that the winds will account for a part of the anomalous conditions in these two years but not for all.

Turning now to the daily weather maps we find in 1880 a succession of highs appearing to the north of Montana and traveling clear across the country, producing distinctive cool or cold waves due to the advance of the high. In 1896, on the other hand, there were almost no highs advancing across the country, and there were hardly any cool waves. This was particularly the case in the Northwestern States. This seems a key to the whole situation. Almost stagnant high areas in the Atlantic States and in the Northwest produced the abnormally high pressure in 1896, while the uniform motion of highs in November, 1880, produced the uniform high pressure over the country.

It remains to inquire why the stagnant high areas in the Northwest gave such low temperatures, while apparently, the

same condition tended to abnormal heat in the Southeast. The solution of this problem is to be sought in the upper atmosphere. The clear, dry air of the Northwest permitted intense heat radiation to the sky, and day after day this was maintained without the interference of moist lows from the Pacific. In other words, we have here an excellent example of the intense radiation-cold experienced in Siberia in the stagnant high pressure of that region, sometimes reaching 31.70 inches. On the other hand the moister air of the Southeast permitted the heat of the low latitude sun to penetrate to the earth, and after the heat reached the earth the moisture prevented its radiation into space. The most important point in this whole discussion is the sharp distinction to be drawn between a radiation-cold, pure and simple, and the cold of our cold waves advancing across the country at 40 and more miles per hour.

NOTES BY THE EDITOR.

SIMULTANEOUS BALLOON ASCENSIONS.

The recent International Meteorological Conference at Paris indorsed the importance of cooperation between the governments and individuals who are now so enthusiastically prosecuting the exploration of the atmosphere and the study of meteorology with the help of the balloon. Perhaps the most important point upon which these can unite is the attempt to secure approximate simultaneity in their ascensions. As the exploring balloon may be sent up without any passengers or aeronauts, but may carry accurate self-recording instruments into regions and temperatures that are inaccessible to man, there is nothing impracticable in the proposal that ascensions be made on any given day at many places over a wide extent of country, so as to give us a general view or possibly a detailed map of the condition of the upper air at that time. Such a series of simultaneous ascensions will undoubtedly frequently be made from European stations, under the general guidance of the special committee on aeronautics recently appointed by the Paris Conference, and in a spirit of scientific cooperation, rather than of national or personal rivalry. Such work was begun by the *Deutscher Verein zur Förderung der Luftschifffahrt*, in Berlin, in 1894, and the first results are collected in a paper by Assmann in the *Zeitschrift für Luftschifffahrt*, XXIV. The first simultaneous ascensions were made from Berlin and St. Petersburg, August 4, and the second, August 9, 1894. A third set, of three ascensions, was made October 1, from St. Petersburg, Warsaw, and Ossowicz. Meantime, in September, 1894, three balloons, the Phœnix, Majestic, and the unmanned exploring balloon Cirrus, with self-registering apparatus, made a simultaneous ascension on the 6th, and as soon as practicable after that the Majestic made a long voyage through the night of the 5th and the daytime of the 6th of October. On December 4 Berson ascended from Stassfurt and descended at Kiel.

The ascensions made November 14, 1896, may be considered as the beginning of a long series of similar international investigations of the atmosphere by means of simultaneous balloon ascensions covering all of Europe. On that date the lowest temperatures observed and the greatest heights attained by balloons at different localities were as follows:

Place.	Height.	Temperature.	Remarks.
	Meters.	° *C.*	
St. Petersburg..	5,000	—24	—27.5° at 4,300 meters.
Warsaw	2,000	—30	
Berlin	6,000	—25.6	
Do.....	5,650	—24.4	Warm air below 3,000 meters.
Strasburg	7,700	—30	—30.0° at 6,000 meters.
Paris	15,000	—60	
Munich	3,500	— 6.5	

The above observations represent the conditions prevailing in the midst of a large area of high pressure that was moving slowly eastward over Europe. At Strasburg and Berlin a layer of warmer air was noted before ascending into the colder air above. On the 14th, 7 a. m., the central isobar of 765 millimeters extended from Finland southward to Greece, and on the 14th, 9 p. m., the isobar of 770 millimeters extended from St. Petersburg south to Bulgaria. The sky was generally cloudless during these balloon ascensions, but cloudy weather soon followed with continued cold at the earth's surface and high pressure from France eastward to the Ural. To the north of this belt temperatures were not abnormally low. Evidently this ridge of 775 to 785 millimeters, extending southeast and northwest between two low areas, represented the slow descent of cold, dry air which flowed away in all directions near the earth's surface; the whole system of sea-level pressures and temperatures could have resulted from a general eastward movement and very slow descent of the layer of cold upper air that was reached by the balloons on the 14th; eventually, it disappeared in the southeast of Europe moving toward Persia. The temperature of a mass of slowly descending dry air follows the laws explained by the Editor in American Meteorological Journal, 1892, VIII, pp. 537–552.

The idea of these simultaneous ascensions seems to have been first urged in 1894 by Berson and Assmann, the assistants of von Bezold in Berlin, and was by them urged upon the attention of the Paris Conference, which voted to encourage such ascensions.

[It may be worth recording that the importance of utilizing simultaneous balloon ascensions and the defects to which our knowledge is subject as long as we neglect the use of the balloon were fully appreciated by the present Editor, who has not failed to urge the systematic scientific use of special balloon voyages and as early as 1871 entered upon his daily weather maps the records of the various ascensions made by professional aeronauts for business purposes; thus, on July 4, 1871, 1872, 1873, respectively, he was able to study the paths of from three to five balloon voyages.—ED.]

In a recent letter from Berson to Hermite, as published in the Aerophile (Oct. 1896, p. 223), Berson corrects several errors which if uncorrected might discourage others from attempting similar work. He says:

1. All the high ascensions of the balloon "Cirrus" from Berlin, so far as they have been published, have been made with ordinary illuminating gas and not with hydrogen; with this gas a height of 18,300 meters has been attained (this altitude is computed after making careful allowance for the temperature of the air and the barometric errors) the great altitudes attained by the "Cirrus" are to be attributed only to the dimensions of the balloon, whose volume is 250 cubic meters.
2. The voyages of the "Cirrus" had nothing whatever to do with the Industrial Exposition of the City of Berlin; they were not for show or sensation but were a part of the systematic work undertaken by the aeronauts and meteorologists of Berlin with the assistance of the German Government and, especially, of the Emperor in person.
3. The German balloon "Cirrus" has not yet been furnished with apparatus suitable for bringing down specimens of the upper air for chemical analysis but has been confined hitherto by Mr. Assmann, to the determination of temperature, pressure, and wind for which purposes the most exact methods have been used.

[As the examination of the moisture contained in a specimen of air brought down from the highest regions would be an admirable check upon any record made by a self-register-

ing hygrometer there is an additional meteorological reason for securing such specimens.—ED.]

4. For high ascensions by aeronauts in person, the Germans have adopted the method of breathing pure oxygen enclosed under a pressure of 150 atmospheres within a steel tube, as being much preferable to Paul Bert's method of carrying a mixture of 30 per cent of oxygen in a gas bag at ordinary pressures. They consider the breathing of pure oxygen a matter of primary importance in such ascensions.

It is well known in America that our own veteran aeronaut, Prof. S. A. King of Philadelphia, has during his life-long experience never failed to urge the importance of balloon ascensions to the meteorologist. In 1871, he in connection with the present writer, laid before the Chief Signal Officer a report recommending that telegraphic stations send up small free balloons in order to ascertain by simultaneous ascents the general direction and velocity of the wind for 1,000 feet above the ground. Although this proposition was not accepted, yet a beginning was made in the utilization of the balloon for meteorological purposes and the following account of the work of the Signal Service is corrected from Bulletin 11, Part 2, p. 275, Report of the International Meteorological Congress held at Chicago, August, 1893:

Through the enthusiastic cooperation of Prof. King the Signal Service was subsequently enabled, at slight expense, to send observers on aerial voyages, as follows: 1872, Mr. Schaeffer ascended with Mr. King from Rochester, N. Y.; 1877, Mr. Ford went up at Nashville, Tenn., on April 3, June 18 and 19; 1881, September 12, Mr. Upton went up from Minneapolis, Minn., and a few weeks later Mr. Hass-Hagen ascended from Chicago. In 1885 an arrangement was made with Professor King by which a number of ascensions were to be made from Philadelphia, Pa., whenever ordered by General Hazen. In accordance with this plan five ascents were made, four of them in the special interest of meteorology, with Mr. W. H. Hammon as observer, and the last one in the special interest of military signaling and balloon photography. Through the kindness of another aeronaut, Mr. Allen, similar privileges were by him accorded to Professor Hazen, who has made several ascensions. The valuable results of all these latter aerial voyages have been published in the American Meteorological Journal.

The recognition thus given, ever since the voyages of Gay Lussac and Glaisher, to the important data that meteorology may obtain by cooperation with aeronauts has been followed by the development of a growing interest in the subject. As the large balloons manned by at least one aeronaut and one observer required a large outlay of money and time, and as such ascensions can not be made in our very coldest weather, nor during high winds, and with difficulty during rain or snow, and as many observers can not ascend,above 25,000 feet without increasing inconvenience and even danger, there is every incentive to develop meteorological aeronautics along the line of activity which was initiated by Berson and Hermite, and has been most successfully pushed by Hergesell and Assmann. In the MONTHLY WEATHER REVIEW for November, 1894, p. 507, will be found some details of the remarkable ascensions made by Dr. A. Berson on December 4, from Berlin; he attained the height of 30,000 feet and the observations made by him were of great value. This represents the very best that has been done by personal ascension. On the other hand the unmanned balloon "Cirrus" from Berlin, attained 55,000 feet, September 6, 1894, and in the MONTHLY WEATHER REVIEW for January, 1896, p. 16, there will be found an account of the ascension near Paris of a small balloon, the "Aerophile," without personal attendant, carrying only a light piece of self-registering apparatus. Two such voyages are there mentioned, that of October 20, 1895, which attained over 50,000 feet, and that of March 27, 1896, which attained 43,000 feet. Science owes a debt of gratitude to Assmann and Berson of Berlin, and MM. Gustave Hermite and Georges Besancon of Paris, who invented the apparatus and carried out these experiments. It is in this line of work that observational meteorology is now to make its next great advances. The photography of the earth, as seen from the balloon, a matter that has recently been much discussed in New York City, has been practiced by the French aeronauts for many years, beginning with Triboulet in 1876, and recently they have added even the photography of clouds. A splendid series of photographs of Philadelphia and its environs was taken by Prof. S. A. King and assistants in 1885.

THE FRANKLIN KITE CLUB.

We have on several occasions published in the MONTHLY WEATHER REVIEW such items as we could gather relative to the Franklin Kite Club of Philadelphia, which seems to have been the most systematic effort as yet made to develop the kite for meteorological purposes. Quite recently Mr. William J. Rhees, who was for many years Chief Clerk of the Smithsonian Institution under Professors Henry and Baird, informed us that he had obtained an interesting item in connection with the life of the late William B. Taylor, who was born in 1821 in Philadelphia, but for over forty years was well known as one of the most learned and able of the scientific men employed in the Patent Office and the Smithsonian Institution.

Mr. Rhees kindly communicates the following abstract from his unpublished manuscript memoir of Mr. Taylor:

While attending school in the winter of 1835–36, Taylor lived with an aunt, who was the matron of the Philadelphia City Hospital (at Schuylkill, Fourth and Coates streets). This hospital was in the middle of a large lot surrounded by a fence, but free from trees or other obstructions.

In 1835–36 several gentlemen formed a society with the name of "The Franklin Kite Club," for the purpose of making electrical experiments. For a considerable time they met once a week at the City Hospital grounds and flew their kites. These were generally square in shape, made of muslin or silk, stretched over a framework of cane reeds, varying in size from 6 feet upward, some being 20 feet square. For flying the kites, annealed copper wire was used, wound upon a heavy reel 2 or 3 feet in diameter, insulated by being placed on glass supports. When one kite was up sometimes a number of others would be sent upon the same string. The reel being inside the fence the wire from the kite crossed over the road. Upon one occasion as a cartman passed, gazing at the kites he stopped directly under the wire and was told to catch hold of it and see how hard it pulled. In order to reach it he stood up on his cart, putting one foot on the horse's back. When he touched the wire the shock went through him, as also the horse, causing the latter to jump and the man to turn a somersault, much to the amusement of the lookers on, among whom was Taylor.

It was this incident and others of a similar character connected with the Kite Club, that turned his youthful mind to science and especially to electrical phenomena.

THE USE OF THE KITE IN METEOROLOGY.

For many years the Editor has been collecting the literature relative to the use of the kite in meteorology, and this collection has been freely used in the writings of Prof. C. F. Marvin and Mr. A. L. Rotch. In a review of this subject by Mr. A. Lancaster, in *Ciel et Terre*, he calls attention to the work of Mr. W. R. Birt and Sir Francis Ronalds, who in 1847 organized a series of experiments at the Kew Observatory, an account of which is given in the London, Edinburgh, and Dublin Philosophical Magazine, September, 1847 (3), XXXI, p. 191, and as the short article is but little known, we reproduce it as follows:

Mr. W. R. Birt (on the 14th of this month, August, 1847) took some kites, etc., to the Kew Observatory, for the purpose of endeavoring to ascertain how far it might be practicable to measure the force of wind at various elevations by their means, and (in the mere manipulation of his experiments) was assisted by Mr. Ronalds. After several trials, etc., they agreed that the sudden variations, horizontal and vertical, in the position of the kite, the great difficulty of making a kite which should present and preserve a tolerable approximation to a plane, that of measuring with sufficient accuracy, at any required moment, its inclination, and lastly, the influence of the tail, would always tend to render the observation somewhat unsatisfactory. Mr. Ronalds then proposed to try the following method of retaining a kite in a quasi invariable given position. Three cords were attached to an excellent hexagonal kite of Mr. Birt's construction; one in the usual manner, and one on each side (or wing). The kite was then raised as usual; the two lateral cords

were hauled downward by persons standing at the apices of a large equilateral triangle (described upon the ground) until the ascending tendency became considerable (even when the force of the wind was at its minimum), and the three cords were made fast to stakes or held in the hand. He had entertained no expectation of the favorable result of this simple and obvious contrivance. The place of the kite did not seem to vary so much as one foot in any direction, and it really appears to him probable that a very large kite or kites might be employed in this kind of manner *often* and very cheaply, as a substitute for a captive balloon in meteorological inquiries, or even (on a very extensive scale) for other requirements in military science, etc. An anemometer, a thermometer, an hygrometer, etc., of some registering kind, etc., might be hauled up and lowered at pleasure (like a flag) by a person standing in the center of the triangle (above referred to), and by means of a line passing through a little block attached to the kite. The cords and kite should of course be of pure silk, for the sake of lightness, combined with extreme strength, and the size and thickness in some measure adapted to the breeze or lighter air. The silk might be advantageously covered with a very light coat of elastic varnish.

With reference to the use of the kite in Belgium, Lancaster says:

About 1880 our late regretted colleague, Fr. Van Rysselberghe whose inventive genius was always on the alert, sought to solve the problem of making meteorological observations at great heights and in free atmosphere by means of kites. He constructed different models of these capable of carrying self-registering apparatus and success seemed about to crown his efforts when he was lured from these studies by a question which was engaging the attention of all investigators, viz, that of telephonic communications at long distances. We know with what ardor he pursued this subject and thus he was lead to completely abandon his kite work.

Among other notes Lancaster states that the so-called Malay kite is a transformation of the Chinese kite, devised by Mr. Millet, of New York City, whose experiments are described in the Aeronautical Annual. The Hargrave kite, so-called after the inventor, Lawrence Hargrave, of Clinton, New South Wales, Australia, is fully described in the successive volumes of the Proceedings of the Philosophical Society at Sydney. A full description is also given by Hargrave in the American Engineer for 1895. This form of kite is generally considered the most perfect of its kind. It has great stability. A kite of one square yard area can raise 6 or 8 pounds of weight. With six kites of two square yards area, 180 pounds can easily be raised from the earth. The total weight of the six kites with the cord would be 35 pounds. It is hardly necessary to say that the lifting force of the kite varies with the velocity of the wind when the surface area of the kite and its angle of inclination remain the same.

The dimensions of the Hargrave kites experimented upon by J. B. Millet, are given by him from the Aeronautical Annual, Boston, 1896, p. 127, and are as follows:

The smallest Hargrave weighed 1¼ pounds and had an area slightly less than 9 square feet and would carry a thermograph weighing 3 pounds. A comparative experiment with a Malay kite weighing nearly 1 pound and having a total surface of 85 square feet, during a wind of from 20 to 25 miles per hour showed that the Hargrave kite had a pull of from 6 to 17 pounds, while that of the Malay kite was from 4 to 9 pounds. From this there results for the Hargrave kite a pull of from 7 to 19 pounds per square yard, but for the Malay kite from 6 to 11 pounds per square yard. The angular altitudes of the kites, as seen from the reel, are 45° to 50°.

THE UPPER CURRENTS OF AIR ABOVE THE INDIAN MONSOON REGION.

Mr. W. L. Dallas, of the Meteorological Office at Calcutta, has published an abstract of an elaborate paper in which he discusses all available observations of the wind, and the direction of motion of the cirrus, cirro-stratus, and cirro-cumulus, and, finally, the highest pure cirrus. The observations refer to the Arabian Sea and the Bay of Bengal, and although his detailed tables and text have a local application, yet the following paragraph will be of universal interest:

In so far as we can trust these observations the registration of the movement of the clouds would undoubtedly be helpful in the determination of the movement of the upper currents of air. The author endeavored to bring the observations now under discussion into unison with the theoretical conclusion that there exists an easterly current when the sun is in the zenith, but at all seasons of the year inflowing northeast and southeast winds, at a moderate altitude, and outflowing winds at greater altitudes; but the recorded observations afford no confirmation of such a circulation. He also attempted to explain the upper currents by means of the assumed distribution of pressure over India at 10,000 feet above sea level. So far as one can see from one example it follows that it would be useless to rely upon observations of the motions of the clouds made by occasional observers in order to obtain any correct idea of the circulation of the upper layers of the atmosphere. This is the result of two causes, the first and most important is that in nearly all cases clouds are a phenomenon belonging to a disturbed condition of the atmosphere, and that the observations of their appearances and motions simply define the nature of the disturbances above the point of observation. As an example, the following case may be mentioned. To the north of Simla lie the snow-covered range of the Himalayas, and on clear winter days, which it may be mentioned, are far more numerous than the cloudy days, one may observe the cumulus clouds which are formed above the snow-covered mountains as the result of local evaporation. These clouds rise and move away from the snow-covered mountain tops above which they are formed and move from the mountain chain toward the southeast, thus demonstrating the existence of a current from the northwest toward the southeast at a level of from 20,000 to 25,000 feet above the sea, or 13,000 to 18,000 feet above Simla. This motion occurs uninterruptedly day after day, but suddenly the weather is disturbed; a depression appears on the daily map over Afghanistan and clouds move over Simla from the southeast and east toward northwest and west; if therefore, there were no artistic clouds produced to the north of Simla, such as occur during fine weather, then would the clouds that now come from the southeast be the only ones that are observed, and the natural conclusion would be that at a height of from 20,000 to 25,000 feet there prevails an upper current from the east and the southeast, whereas really this is an exception, and as a rule the current is from the opposite side. This would seem to show that a determination of the normal movement of the upper atmospheric circulation, by means of the ordinary observation of the clouds, is a process of very doubtful value.

Another important point is the classification of the clouds by different observers according to their altitude. In the case of the Indian monsoon region we may assume that there are three different atmospheric motions during the progressive advance of the southwest monsoon, which three movements are partially blended together above any given point. The lowest is the movement from the southwest which prevails from the surface of the ground up to very considerable altitudes and in which are numerous cumulus clouds. Above this the movement from southeast and east prevails; this current corresponds to the southeast trade wind in other tropical regions, but it now appears to belong to the upper atmosphere because of the monsoon below, at the surface of the earth. Finally, we have the return current from the thermal equator toward southern latitudes. Now it is exceedingly improbable that when these three currents exist clouds should be present in all three simultaneously. Consequently we come upon an inevitable confusion when one observer classifies certain clouds in the southeast current and certain others at a different time in the upper return current, as upper clouds in both cases and thus leads astray the investigator who is making the attempt to discuss all observations systematically in the same way.

An unusually careful and painstaking observer who is stationed at one place and desires to develop a theory on the basis of the continued study of the movements, forms, and altitudes of clouds that pass above him, might possibly be able to attain an approximate estimate of the changes of the weather that are now in progress, or even those that are about to happen in his neighborhood; but the author doubts very much whether it will be possible for him to determine the general motion of the air in the upper strata of the atmosphere with the help of the cloud observations that are made by a variety of observers at a variety of places and at very different times.

This is very much to be lamented since such a determination of the approaching weather is perhaps at present the most important demand that is made on meteorology.

THE ORIGIN OF TYPHOONS AND HURRICANES.

The study of the formation and development of cyclones has been followed with the greatest minuteness under exceptionally favorable conditions by the meteorologists of India. In a recent essay (An Account of a Storm Developed in Equatorial Regions, Calcutta, 1896), Mr. W. L. Dallas has endeavored to decide whether the inrush of a saturated stormy wind from the southwest into a region of heated moist air, is

essential to, or the determining cause of, the formation of a cyclonic whirl. He finds that it is not necessary and gives in detail the facts of a special case over the Bay of Bengal between the 1st and 15th of December, 1894. His conclusions are favorable to the general correctness of the ideas developed by Professor Ferrel who, as is well known, gave a more precise expression to the principles taught by Espy. According to these meteorologists, when a general uniformity of pressure and quietness prevails in the atmosphere, especially over the ocean, and when the quiet air becomes so warm and moist that ascending currents and clouds are forming here and there over the warm region, then any one of these ascending currents may be so fed with moist air as to steadily increase in its volume and instability; it rises and the surrounding air that is drawn in begins a gyratory motion, usually in the cloud regions, but which is soon propagated downward to the earth's surface. The quiet region in which the instability first occurs is often that which is called the doldrums; if this is not located at the equator, but five or ten degrees north or south, depending on the season, then the gyration of the winds around the center is fully determined by the deflecting action resulting from the diurnal rotation of the earth on its axis.

In summing up the results of his study of this storm Mr. Dallas says:

On the first three days of December, 1894, the Indian daily weather charts exhibited a typical illustration of the ordinary meteorological conditions which theory assigns to the Belt of Calms. An area of continuous low barometer lay over the equator, on either side of which the two trade wind currents blew freshly, while within the area itself, the surface winds were very light and variable. The weather was fine generally, but daily, at 4 p. m., just after the diurnal period of greatest evaporation, heavy precipitation of rain took place. The charts for these days show, then, a more or less inclosed area within which the weather was fine, and constant evaporation was proceeding with apparently no horizontal outlet for the accumulating aqueous vapor. On the 3d of December the southeast trades seemingly began to take off, but the observations on this day show that nearly all the ships in southern latitudes had entered or were close to the inclosed area of light and unsteady winds and low barometer. The sky was densely clouded, and though heavy rain fell for a time during the later hours of the day, this outlet was probably insufficient to stay the steady accumulation of aqueous vapor over the inclosed area. In the afternoon of this day (3d) the vessel *Falls of Garry*, in latitude 5° south, reported the cessation of the southeast trades, their replacement by light, variable, "puffy" breezes and heavy rain. By the 4th the process of accumulation of aqueous vapor had apparently reached its maximum and the subsequent condensation had set in. A continuous downpour of rain was reported, and this was accompanied with light, variable airs and calms on all the ships within the inclosed area. At the same time as the constant rapid condensation proceeded so did atmospheric pressure diminish, so that by the morning of the 6th a well-defined central area of depression had been developed within the inclosed area almost directly over the equator. It is interesting to note that so far as can be judged from the observations, at the period when the process of constant evaporation had resulted in a saturated condition of the atmosphere over the inclosed area, and the subsequent process of sudden, rapid, and extensive condensation had succeeded, there apparently occurred a slight but appreciable rise of pressure over the whole equatorial region under observation. This rise was shown by the chart of 8 a. m. of the 4th (not reprinted), and it will be remembered that it was after 4 p. m. on the 3d that the process of rapid condensation set in and became the most important of the changes in progress over the area.

If the above be the explanation of the initiation of the storm, then further inquiry would be unnecessary, as the principle of evaporation and condensation is a general and not a local one and is as applicable to equatorial regions as to other parts of the earth's surface. Further, it is unnecessary from this point of view to introduce a force to account for the gyratory motions, as the theory presupposes an irregular inflow of the surrounding air as pressure diminishes, an inflow which can only result in a vorticose or spiral motion of the atmosphere converging towards a center, while for the gradual increase in the intensity of the barometric depression and in the force of the winds an adequate cause is assigned in the rapid condensation and precipitation of rain accompanying the inflowing currents of air when once the center is developed. * * * Two minor points of interest connected with the disturbance deserve perhaps passing notice. The first is the torrential rain which accompanied the disturbance throughout its course. This rainfall was apparently associated with a stream of air from trans-equatorial regions, and as soon as this supply was cut off and the wind shifted to northeast again, to the south of the disturbance the rainfall decreased and the intensity of the disturbance diminished. The second is the sharply defined limits of the disturbance. Hardly any indication of the presence of a storm was afforded by the coast observations. So much so indeed was this the case that the rainfall which occurred around the head of the Bay on the 14th and 15th when the center of disturbance was in latitude 18° and 20° N was ascribed to disturbed weather in Upper India instead of its actual source, viz, the depression over the Bay.

THE LOW AREAS ON OUR PACIFIC COAST.

The daily chart for the Northern Hemisphere accompanying the Bulletin of International Simultaneous Meteorological Observations, 1875–1887, has long since familiarized the student with the fact that areas of low pressure frequently pursue very long paths for many consecutive days, in their circuit around the north temperate regions. Those that start in the equatorial portions of the Atlantic or Pacific, after passing northwest and curving to the northeast, finally move east-northeastward between the forty-fifth and sixty-fifth parallels. Others start in the temperate regions, and, without moving to the westward or recurving, pursue nearly the whole path in an east-northeast direction. In describing the history of areas of low pressure the authors who have contributed these chapters to the successive MONTHLY WEATHER REVIEWS for nearly twenty-five years past have usually kept in mind the fact that lows which first appear in Washington, Oregon, Montana, and Alberta, or British Columbia, have probably originated at some point far to the west, and if occasionally the description of such a storm begins by speaking of it as originating over our North Pacific Slope Region, this is a slip of the pen which the reader may generally interpret without being misled by it.

The Editor has on several occasions pointed out the fact that the isobars and therefore the winds at a considerable distance above the earth's surface have very little resemblance to the isobars and winds at sea level. In fact, the normal isobars at an elevation of 5,000 meters (which represents a surface a little above the summits of the Rocky Mountains) present a grand oval depression whose longest axis extends from the United States toward the north-northwest over the Saskatchawan and the Arctic regions to eastern Siberia. (See Chart VII, herewith.) By studying a polar projection of the Northern Hemisphere we perceive that the whole upper circulation of winds and clouds and the general movement of areas of low pressure and high pressure are related to this distribution of pressure in the upper layers of air. When a storm center moves from Japan to the North Pacific, or from the latter to our Pacific Coast, or from Alberta and Oregon southeastward, or from Texas and Kansas northeastward, it is describing some portion of a circuit about this great upper region of low pressure. It is simply a special whirl gliding about in the maelstrom that occupies one-half of the northern hemisphere. The axis of this oval polar maelstrom probably changes its position with considerable regularity, oscillating slowly to and fro; therefore, the paths which the smaller disturbances describe will vary simultaneously with that; sometimes the storms will move far to the south either in America or in Russia in order to circumnavigate the southern extension of the longer axis of the oval but will thereby diminish in intensity and almost die out. Sometimes a new whirl will start at the southern end of the oval; sometimes all the paths of the low areas will lie on the northern border of the United States and Canadian weather charts because the polar maelstrom has altered its dimensions and locations. Even the great subpermanent areas of low pressure in the North Atlantic and North Pacific are subordinate to the greater area of low pressure at the upper level and its attendant winds.

These remarks are appropriate to a note from Mr. Alexander McAdie, local Forecast Official at San Francisco, in which he says:

A little study of weather types on the Pacific Slope makes it plain that certain conditions traverse the country from the Pacific; thus to take at random the month of January, 1895, some of the deep lows that might have been supposed to originate over Manitoba or further west over Assiniboia, Alberta, and British Columbia, did not so originate but are storms that can be traced distinctly in their onward march from the northern-central Pacific Ocean northeastward, often recurving and doubling in their paths, but preserving identity. Passing south of Sitka they march eastward and reach Newfoundland in about 120 hours. For example, a storm passed from Sitka to St. Johns between January 12 and 17. This storm did *not* originate in the Northwest Territory but clearly came in from the Pacific. Where it did originate we do not know, but it is an error to locate its origin in any of the Northwest Territories. And this is probably true of most storms which are said to originate over Athabasca or Saskatchewan. The truth is that storms first come into notice in these localities but originate elsewhere.

In preparing the chapter on high and low areas for the MONTHLY WEATHER REVIEW for January, 1895, Mr. A. J. Henry (whose name in the absence of the Editor was accidentally omitted in that connection) makes note on page 3 of the fact that:

The storms of the Pacific Coast present a characteristic that is worthy of special study, viz, an apparent oscillation from the ocean to the land, and *vice versa*, that is to say, the low approaches the coast and partially disappears, reappearing within a period of twelve to thirty-six hours, and continuing this action until the storm finally disappears.

This same phenomenon has recently been indepently noted by Mr. W. H. Hammon, Forecast Official, Weather Bureau at San Francisco, who, under date of November 14, states that:

During the past two years I have been engaged during my leisure time in preparing weather charts of the Pacific Ocean. Some remarkable information has been obtained from these charts. The storms that approach the Pacific Coast from the ocean, frequently recurve several times after touching the coast, the number of such oscillations being greater the farther south the storm approaches the coast.

The fact that a storm moves southward, ricochetting along the Pacific Coast, and probably dying away as it progresses, harmonizes with the general theory of the movement of vortices. If the general distribution of pressure at sea level, and especially at 16,000 feet, is such as to give the storm center a general movement southward or southeastward along the Pacific Coast, then the influences of the high mountain land in the interior of California and of the plateau lands of Idaho, Nevada, Oregon, Utah, and Arizona are like those of a barrier against which a small atmospheric vortex may strike only to be reflected several times in succession. A further special influence of these high lands is to furnish descending dry air whose mixture with the moist air of the whirlwind rapidly diminishes the quantity of condensation and the sustaining power of the whole mechanism. The inverse conditions prevail on the east slope of the Rocky Mountains, where, therefore, a whirl once started is apt to increase in all characteristic phenomena. Possibly this process is illustrated by the low area of October 29, 1886, in regard to which Mr. McAdie writes:

On Monday, October 26, a. m., a low, 26.70, with southeast winds, appeared on the Oregon coast. Taking a most unusual course this storm passed southward, and on the morning of the 27th was over central California (San Francisco, 29.56, southeast wind, 1.10 inches rainfall). By 10 o'clock of the same day the storm was moving up the San Joaquin Valley, and heavy rain was falling over southern California. On the morning of the 28th the pressure was 29.78 at El Paso, with rain, and the storm was out of our limits of observation, but just coming into prominence elsewhere. Its subsequent history is plain.

HIGH-LEVEL ISOBARS.

In a preceding note the Editor has remarked that the movements of low areas across North America are elucidated by studying the upper isobars of the Northern Hemisphere. Maps of these isobars would doubtless be more frequently constructed and studied were we not hindered by the apparent uncertainty of reducing pressures observed at a low level upward to some considerable altitude; especially might one be hindered by the great labor of computing many such reductions. A rigorously correct reduction upward requires that we know the average temperature of the column of air above each station, and this is practically impossible in the present state of meteorology, though it may become practicable when balloons and kites have been more widely utilized. Meanwhile we must be content with rather crude approximations, but this will not lead us astray if we keep clearly before us the extent to which our data are liable to be in error. The preparation of a daily chart of upper isobars, say for 8 a. m. and 8 p. m., standard time, could hardly be seriously undertaken unless we had actual observations of the upper temperatures from balloons or kites or mountain peaks, but the preparation of monthly and annual normal charts for the level of 5,000 meters may, perhaps, be undertaken with satisfactory success at the present time. The laborious numerical computations of the pressures at this upper level can be entirely avoided by using the very convenient method suggested by Moeller in 1882, and elaborated by Koeppen in the *Met. Zeitschrift* for December, 1888. By omitting illusory refinements Koeppen has thrown all the labor into the use of a single table, which he gives in metric measures. The following table reproduces in English measures the second of the tables given by Koeppen.

Atmospheric pressure at 5,000 *meters, or* 16,404 *feet.*

[The arguments are: Pressure at sea level, and the average temperature of the intervening layer of air, which is approximately the actual temperature at 2,500 meters.]

Column temperatures (Fahrenheit).	Sea-level pressure (inches).								
	27.99	28.37	28.74	29.13	29.52	29.92	30.32	30.73	31.14
°	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*
75.2	15.82	16.04	16.25	16.47	16.69	16.92	17.15	17.37	17.61
63.7	15.61	15.82	16.04	16.25	16.47	16.69	16.92	17.15	17.37
52.7	15.41	15.61	15.82	16.04	16.25	16.47	16.69	16.92	17.15
42.1	15.20	15.41	15.61	15.82	16.04	16.25	16.47	16.69	16.92
32.0	15.00	15.20	15.41	15.61	15.82	16.04	16.25	16.47	16.69
21.9	14.80	15.00	15.20	15.41	15.61	15.82	16.04	16.25	16.47
12.2	14.61	14.80	15.00	15.20	15.41	15.61	15.82	16.04	16.25
3.0	14.41	14.61	14.80	15.00	15.20	15.41	15.61	15.82	16.04
— 6.0	14.22	14.41	14.61	14.80	15.00	15.20	15.41	15.61	15.82
—14.8	14.03	14.22	14.41	14.61	14.80	15.00	15.20	15.41	15.61
—23.3	13.85	14.03	14.22	14.41	14.61	14.80	15.00	15.20	15.41
—31.4	13.66	13.85	14.03	14.22	14.41	14.61	14.80	15.00	15.20
—39.1	13.48	13.66	13.85	14.03	14.22	14.41	14.61	14.80	15.00
—46.7	13.30	13.48	13.66	13.85	14.03	14.22	14.41	14.61	14.80
—53.9	13.13	13.30	13.48	13.66	13.85	14.03	14.22	14.41	14.61

This table is so arranged that the same pressure at the upper level, for instance 16.25 inches, is repeated as we proceed downward and to the right; that is to say, there is a series of pairs of sea-level pressures and column-temperatures that will reproduce the same upper level pressure, *e. g.*, 75.2° and 28.74 inches; 63.7° and 29.13 inches; 52.7° and 29.52 inches, etc. In other words, a lower column-temperature may so counterbalance a higher sea-level pressure as to give the same upper-level pressure. One method of using this table consists in picking out by interpolation the upper reduced pressure for any given column temperature and sea level pressure, but this would be very laborious on account of the double interpolation, even if our little table were enlarged tenfold. By far the most expeditious method of applying Koeppen's table was suggested by Moeller and is as follows: Let there be given a chart of sea-level isobars and isotherms; assume a rate of upward diminution of air temperature and calculate how much this would amount to in 2,500 meters; subtract this amount from the temperatures inscribed at the end of our sea-level isotherms, and they at once become isotherms for the level of 2,500 meters, that is to say, they represent the average temperature of a layer 5,000 meters thick, or the argument that appears in the left-hand column of the above table. We now draw another set of 2,500 meter isotherms, which are interpolated between those already drawn, so as to exactly represent the column-temperatures, 75.2° F., etc., as given in the above table. In a similar way we now draw a second set of sea-level

isobars by interpolation between those already drawn on the map, which new isobars shall represent the pressures, 27.99 inches, 28.37 inches, etc., as given at the heads of the respective columns of the above table. Where the new isotherm of 75.2° intersects the isobar, 27.99 inches, we have a point that may be marked as belonging to the upper isobar of 15.82 inches. Another point on this same isobar will be the intersection of the isotherm 63.7° F. with 28.37 inches; another point will be the intersection of 52.7° with 28.74 inches, etc. By joining these points, therefore, we have at once the upper isobar of 15.82 inches. In this way the laborious computation is wholly avoided, and the entire process consists simply in drawing on the original chart two new sets of isobars and isotherms properly related to each other as required by the above table, so that by joining the intersections of these new curves we at once construct the upper isobars.

Usually the principal source of uncertainty in the upper isobars is due to the temperature assumed for the 2,500 meter level and it is very possible that there may be an error of 10° F. in this datum; the above table shows that such an error will affect the upper isobar by about 0.2 inch, but the error will probably be quite symmetrical over large regions and will, therefore, not seriously affect the general contour of these isobars or the gradients between them.

Bearing in mind this uncertainty of the temperature, the accompanying Chart VII was constructed in 1895, according to the above method, from the charts given by Buchan in his Report on Atmospheric Circulation which is Part V of the Physics and Chemistry of the second volume of the Scientific Results of the Voyage of H. M. S. *Challenger*. Buchan's maps represent the normal data for December for the Northern Hemisphere. His isobars represent pressures reduced to standard gravity. In order to avoid confusion the sea-level isobars and isotherms have been omitted from Chart VII and only the upper-level isobars for 5,000 meters are shown. These upper isobars evidently constitute a single system from the equator to the polar regions. The special oceanic low pressures, which are a marked feature in the North Atlantic and North Pacific in December, almost disappear, being represented only by a widening of the upper isobars for a short distance between Iceland and France and in Bering Sea. On the other hand the continental areas of high pressure are now converted into smooth isobars tending to low pressures.

These upper isobars represent the result rather than the cause of the general circulation of the atmosphere. If it were not for the irregular resistances and temperatures over the continents and oceans we should undoubtedly have symmetrical circular isobars representing a maelstrom with the north pole at the centre and due to the general flow of the upper air from the equatorial belt toward and around the polar regions. As it is, however, the warmer temperature, the moisture, and the absence of special resistances, over the North Pacific and the North Atlantic oceans, combine with the low temperature, the dryness and the large resistances over the Eastern and Western continents, to produce winds that determine an oval system of upper isobars whose longest axis reaches from Hudson Bay toward the northwest over the polar regions into eastern Siberia and the valley of the Lena. If the temperature of the column of air has been assumed too low in the northern regions, as is rather likely, then our upper isobars may be a little too low and upper gradients too steep, but with due allowance for this uncertainty it still remains true that the presence of the great continents has distorted the symmetrical circles into very long ovals. The general path of a particle of atmosphere at this upper level can be approximately estimated from these upper isobars; it must be steadily descending in its circulation around the Arctic regions and the principal places of descent must be over the continents, *i. e.*, in the valley of the Mackenzie and upper Missouri, as it tries to turn the sharp curve at the American end of the oval and, again, over northern Russia and Siberia, as it tries to turn the sharp curve in the upper isobars over China and Siberia.

The study of these upper isobars explains the fact that the high pressure areas of North America in the first part of their course are usually observed to move from the northwest while similar areas in Europe move at first from the southwest but afterwards from the west. The great area of high pressure and cold, clear weather that prevailed over southern Europe November 17–27, finally disappearing over Persia, is a good example of such motion eastward; as a result it is quite possible that this area may have brought to upper India light snow, followed by cold, dry weather, about the 1st of December, 1896.

The upper currents over the North Pacific drive a mass of air eastward or southeastward over Alaska and British America, where it settles down, and by reason of its greater coldness, density, and centrifugal force, is driven southward as cold waves over the United States. Similarly, the strong west current over the North Atlantic forces a mass of air over Sweden and Russia that must eventually spread southeastward either as a "buran" over Siberia and China, or as a cold wave over Persia into northern India. At the surface of the Eastern and Western continents there is a flow of cold, dry air southeastward (sometimes southwestward) that is the mechanical consequence of the locations of the two oceans in respect to these continents, by reason of which the west and southwest winds have free sweep over the oceans on the west. By this arrangement Ferrel's symmetrical circulation over an ideal smooth globe, which would always represent a condition of unstable equilibrium and numerous discontinuous motions, is converted into an almost stable system of circulation during December, January, and February; not indeed a perfectly stable, steady motion, but an approximation thereto which would doubtless become perfect if the winter season lasted continually.

THE TENNESSEE RIVER AND FLOOD SYSTEM.

Mr. L. M. Pindell, Weather Bureau observer, in charge of the Chattanooga station and Tennessee River and Flood Service, has just published a general report, with the permission of the Chief of the Bureau, and by means of funds contributed by the business men of Chattanooga. The object of the report is to give the public all the information collected, and to so classify the data that any one can use the same with success. Besides giving all detailed river data for ten stations, and a special report on the flood of April, 1896, there are some interesting general paragraphs relative to other floods, and the following, which we quote, relative to the general regimen of the Chattanooga watershed:

The waters from Virginia and North Carolina help to feed the volume of the Tennessee River at Chattanooga, and eventually pass into the Cumberland River at Paducah, Ky. The French Broad, Holston, and Clinch rivers are the most important factors in furnishing the Tennessee her water supply. The Little Tennessee is also an important river, but the rise in this tributary, while of considerable height and importance, does not affect the main body of the Tennessee River like the Clinch or French Broad. The Hiawassee is a very quick and rapid rising tributary. It sometimes rises 10 to 12 feet in one day, and falls from 6 to 9 feet the next. This river generally checks the falling tendency of the Tennessee. A heavy rainfall and a rapid rise over the Hiawassee will only cause a rise of about 3 feet at Chattanooga. The drainage area above Chattanooga is 21,000 square miles; 2,800 above Clinton; 16,200 above Kingston or Rockwood; 3,400 above Strawberry Plains; 8,300 above Knoxville; 11,500 above Loudon, and 2,200 above Charleston.

Under ordinary conditions, that is, when the ground is fairly moistened and does not absorb very much of the rainfall, and when the rainfall is general over the entire system, the rise at Clinton and Kingston averages 3.9 feet for every inch of rainfall; 3.6 feet at Knoxville, Lou-

don, and Rockwood; 3.8 feet at Charleston, and 4.9 feet at Chattanooga. When a 5-foot stage is at Chattanooga, with the ground moist, and a general and heavy rainfall occurs over the system, the first inch of rain will cause a rise of about 7 feet at Chattanooga, the next 2 inches about 5 feet, and as the river reaches the 25-foot mark the rise is about 3.7 feet to an inch; after it passes the 33-foot mark, or danger line, the rise is less per inch of rainfall, owing to the lowlands that are then flooded. At the 40-foot stage the rise is 2.5 feet for every inch of rain; this is when the rainfall is general and steady; but when the rainfall is exceedingly heavy, and the river is at a 20-foot stage at Chattanooga, the average rise is about 4 feet to every inch of rainfall. This is the average based upon the records from 1879 to 1895, but it has been frequently noticed during the past two years that a general rain of from 1 to 1¼ inches over the system causes only a slight rise in the Tennessee River and tributaries, especially during the summer and fall months. The only solution that can be given for the failure of the rivers to rise to their estimated height is because the ground absorbs a very large portion of the water and very little finds its way into the river channel. It is also noticed that the river in the past few years falls faster than in former years, and when it begins to fall, half an inch of rainfall has little weight in checking its falling tendency. It is evident that the destruction of the forests over the headwaters affects the rises in the river by exposing more absorbing surface, while previous to the removal of the timber the ground was always moist or wet, absorbed very little of the rainfall, and nearly all the water found its way into the river, or, in other words, the blanket has been removed. It will be found to be the fact that heavy rainfall over the south side of the Tennessee River will cause only a slight rise at Chattanooga, but a heavy rainfall over the northern side or entire river system will give a greater and more rapid rise. A rise at Clinton (distant by river 141 miles) takes about sixty hours to reach Chattanooga; Kingston (95 miles) and Rockwood (83 miles), thirty-six hours; Knoxville (154 miles), fifty hours; Loudon (109 miles), forty hours; Charleston (53 miles), twenty-four hours.

In most of the rivers of the world, the occurrence of a special high water at any particular station is usually found to result from the fact that certain floods starting at different times in the different tributaries and flowing down stream at different rates of speed have arrived at the station almost simultaneously. We can but think that the destruction of forests is a minor matter, and that a concurrence of floods from the upper watersheds of the tributaries of the Tennessee is essential to the production of the highest floods at Chattanooga, such as that of March 1, 1867 (58.05 feet), March 1, 1875 (53.98 feet), March 11, 1884 (42.8 feet), and April 3, 1886 (52.2 feet). On page 14 Mr. Pindell notes:

That each successive high water since 1867 has been less than the previous one, and that this is evidently due to the extensive improvements made on the river by the United States Engineer Corps. The discharge of the river at both rising and falling stages was measured in 1893 by the officials of the Weather Bureau. When the river reaches the 3-foot stage that is considered the opening of navigation when the river is rising and the closing of navigation when it is falling. The total number of days when the river was at or above the 3-foot stage has, during the past seventeen years, varied between two hundred and ten and three hundred and thirty-five days as the extreme limits. Occasionally the river is frozen over at Chattanooga, as for instance January 12–14, 1886; January 14–22, 1893, and February 14, 1895. The zeros of the river gauges at the river gauge station above mentioned have the following elevations above mean sea level: Strawberry Plains, 859.79 feet; Knoxville, 806.60; Loudon, 737.10; Rockwood, 699.70; Chattanooga, 630.64; Clinton, 782.30; Kingston, 712.80; Charleston, 684.00.

On page 29 Mr. Pindell reprints a table and note, first published in the Annual Report of the Chief Signal Officer, 1891, in which is given the water stages at Clinton and the corresponding maximum water stages at Chattanooga two days later. For instance, a 5-foot stage at Clinton is followed by a 6.2 stage at Chattanooga, but a 45-foot stage at Clinton by a 52.2 stage at Chattanooga, and proportionately at intermediate stages, but these figures are liable to considerable irregularities because of the unevenness of the rainfall over the valleys of this high region and the fact that so many tributaries must conspire to produce considerable high water at Chattanooga.

MEXICAN CLIMATOLOGICAL DATA.

In order to extend the isobars and isotherms southward so that the students of weather, climate and storms in the United States may properly appreciate the influence of the conditions that prevail over Mexico the Editor has translated the following tables from the current numbers of the Boletin Mensual as published by the Central Meteorological Observatory of Mexico. The data there given in metric measures have been converted into English measures. The barometric means are as given by mercurial barometers under the influence of local gravity, and therefore need reductions to standard gravity, depending upon both latitude and altitude; the influence of the latter is rather uncertain, but that of the former is well known. For the sake of conformity with the other data published in this REVIEW these corrections for local gravity have not been applied. One additional station, Topolobampo, is published at the end of Table II.

Mexican data for September, 1896.

Stations.	Altitude.	Mean barometer.	Mean temperature.	Relative humidity.	Precipitation.	Prevailing direction. Wind.	Cloud.
	Feet.	*Inch.*	° *F.*	%	*Inch.*		
Colima (Seminario)	1,663.4*	28.25	78.1	79	5.11	sw.	.....
Colima	*	.....	79.3	.....	.....	.....	.....
Guadalajara (Obs. d. Est.)	5,140.8	24.97	69.8	89	7.95	ne.	e.
Guanajuato	6,761.3	23.68	66.6	60	3.20	wsw.	w.
Jalapa	4,757.3	25.55	68.4	86	7.57	n.	.....
Lagos (Liceo Guerra)	6,274.7	24.15	67.6	65	2.79	ne.	e.
Leon	5,901.0	24.29	68.2	65	4.46	s.	e.
Magdalena (Sonora)	.....	.....	81.1	.....	15.94	.....	.....
Mazatlan	24.6	29.84	83.8	78	5.60	w.	e.
Merida	50.2	29.86	81.3	80	3.34	ne.	w.
Mexico (Obs. Cent.)	7,488.7	23.07	62.4	69	3.32	n.	ne.
Morelia (Seminario)	6,401.0	23.96	62.4	76	3.74	s.	ene.
Oaxaca	5,164.4	25.06	71.6	73	4.42	nw.	ne.
Pachuca	7,956.3	22.55	57.4	71	3.53	ne.	ne.
Puebla (Col. Cat.)	7,112.0	23.42	65.1	68	4.26	.....	.....
Queretaro	6,069.7	24.17	67.6	66	2.93	e.	.....
San Luis Potosi	6,201.9	24.14	69.6	66	1.63	e.	e.
Silao	6,063.1	24.26	70.2	73	1.77	ne.	ne.
Tacubaya (Obs. Nac.)	7,620.2	.....	.....	.....	.....	.....	.....
Toluca	8,612.4	21.91	57.6	72	3.59	w.	.....
Trejo (Hac. Silao, Gto.)	6,010.6	.....	.....	.....	7.23	.....	.....
Zacatecas	8,015.2	22.55	63.3	63	5.17	e.	e.

*These altitudes have been variously published in the original "Boletin," and a clerical error has also slipped into the MONTHLY WEATHER REVIEW. A further explanation will be given as soon as possible.

Mexican data for October, 1896.

Stations.	Altitude.	Mean barometer.	Temperature. Max.	Min.	Mean.	Relative humidity.	Precipitation.	Prevailing direction. Wind.	Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Campeche	.....	.....	.....	.....	.....	.....	.....	.....	.....
Colima (Seminario)	1,663	28.25	88.2	65.1	76.5	80	8.14	wsw.	.....
Colima	.....	.....	.....	.....	77.7	.....	.....	.....	.....
Guadalajara (O. d. E.)	5,141	24.98	80.6	59.0	68.0	82	4.01	sse.	e.
Guanajuato	6,761	23.68	81.0	54.9	64.9	65	4.13	sw.	e.
Jalapa	4,757	25.55	84.4	54.5	66.9	88	7.47	e.	.....
Lagos	6,275	24.14	81.9	49.8	64.6	71	3.46	sw.	sw.
Leon	5,901	24.30	81.9	52.0	66.0	68	1.22	s.	sw.
Magdalena (Sonora)	.....	.....	88.0	59.9	76.8	.....	4.61	ne.	n.
Mazatlan	25	29.87	89.4	66.2	80.8	80	4.79	nw.	sw.
Merida	50	29.89	96.8	66.7	80.6	76	0.38	ne.	e.
Mexico (Obs. Cent.)	7,489	23.07	75.4	49.1	61.3	71	4.13	nw.	ne.
Morelia (Seminario)	6,401	23.96	75.4	50.0	61.3	76	3.99	s.	s.
Oaxaca	5,164	25.06	86.5	52.5	70.7	66	3.72	nw.	ne.
Pabellon	6,312	.....	.....	.....	.....	.....	.....	.....	.....
Pachuca	7,956	22.57	76.3	45.1	58.8	73	1.06	ne.	ne.
Puebla (Col. d. Est)	.....	.....	.....	.....	.....	.....	.....	.....	.....
Puebla (Col. Cat.)	7,112	23.37	.....	.....	64.8	68	3.11	.....	.....
Queretaro	6,070	.....	.....	.....	.....	.....	.....	.....	.....
Saltillo (Col. S. Juan)	5,377	24.88	77.5	53.2	63.0	70	3.50	s.	n.
San Luis Potosi	6,202	24.13	77.2	54.0	64.6	72	3.13	e.	w.
Silao	6,063	24.26	77.5	58.5	68.4	76	2.80	w.	w.
Tacámbaro	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tacubaya (Obs. Nac.)	7,620	.....	.....	.....	.....	.....	.....	.....	.....
Tampico (Hos. Mil.)	38	29.92	88.5	66.2	77.5	77	3.27	se. & ne.	se. & ne.
Tehuacan	5,453	.....	.....	.....	.....	.....	.....	.....	.....
Toluca	8,612	21.91	70.9	42.3	56.1	74	3.46	sw.	.....
Trejo (Hac. Sil., Gto.)	6,011	.....	.....	.....	.....	.....	3.28	.....	.....
Veracruz	48	29.98	91.9	68.9	80.4	76	5.37	ne.	.....
Zacatecas	8,015	22.53	77.4	45.9	58.8	73	6.99	sw.	e.
Zapotlan (Seminario)	5,125	25.08	82.8	59.0	68.7	.....	5.74	se. & n.	e.

For text descriptive of tables and charts see page 16.

TABLE I.—*Climatological data for Weather Bureau Stations, November, 1896.*

Stations.	Elevation above sea-level, feet.	Length of record, years.	Pressure in inches.			Temperature of the air, in degrees Fahrenheit.								Humidity and precipitation.				Wind.			Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Monthly temperature data since opening station.			
			Mean pressure, 8 a. m. and 8 p. m. + c.	Mean reduced.	Departure from normal.	Mean max. and min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.			Absolute maximum.	Year.	Absolute minimum.	Year.
New England.						45.0	+ 3.4										2.85	— 1.1											
Eastport	76	34	30.07	30.16	+ .19	38.4	+ 1.0	60	17	46	10	23	31	37	32	80	3.69	— 0.6	15	8,658	n.	47	se.	11	3	8	19	7.7	64	1888	—13	1875
Portland, Me	103	25	30.08	30.13	+ .12	40.4	+ 2.6	72	17	48	15	25	33	37	33	79	2.45	— 1.6	13	5,235	n.	34	s.	11	5	8	17	7.1	72	1896	— 6	1875
Northfield	872	10	29.20	30.16	+ .12	37.1	+ 4.1	69	17	47	— 3	23	28	44	30	79	3.55	+ 0.3	13	7,771	s.	42	se.	11	3	7	20	7.9	70	1888	—14	1891
Boston	125	27	30.05	30.19	+ .16	46.5	+ 3.8	72	8	54	31	21	*	43	39	85	3.70	— 0.9	13	7,961	nw.	33	sw.	14	9	10	11	5.4	66	1895	19	1894
Nantucket	14	11	30.18	30.19	+ .12	48.5	+ 3.9	62	8	52	36	23	42	35	36		2.49	— 2.4	12	12,832	sw.	52	sw.	15	10	10	10	5.6	67	1881	5	1875
Woods Hole		19				47.1	+ 2.8	62	8	52	36	23	43	36	36		2.93	— 0.3	14	.....	sw.			15	10	10	10	5.6	67	1881	5	1875
Vineyard Haven		11				50.5	+ 4.7	67	8	58	36	23	43	36	36		2.47	— 1.7	10	11,406	sw.	46	w.	15	6	7	17	.....	72	1893	20	1887
Block Island	37	17	30.18	30.21	+ .15	48.2	+ 2.5	64	5	53	30	21	44	38	35	44	2.62	— 1.3	9	.....	nw.			5	6	7	17	5.8	70	1881	19	1890
Narragansett Pier		15				46.7	+ 3.7	66	2	54	30	23	39	38	36		2.62	— 1.3	9	.....	nw.			5	7	7	16	6.6	72	*	2	1875
New Haven	107	24	30.08	30.20	+ .13	46.3	+ 4.4	72	17	54	33	23	39	36	37	76	2.33	— 1.6	10	6,825	n.	41	s.	5	7	10	13	6.6	70	*	— 10	1875
Mid. Atlan. States.						55.8	+ 4.2								38	81	2.71	— 0.5						23	7	10	13	6.6	70	*		
Albany	85	33	30.10	30.20	+ .13	44.0	+ 3.4	67	17	51	20	23	37	29			1.80	— 1.2	13	6,179	s.	36	se.	27	3	9	18	7.4	.....	.....	.....	.....
Binghamton	875	...				43.8	.....	69	18	52	19	30	35	41	38	88	1.78	.....	14	5,144	w.	34	sw.	23	5	9	13	6.1	74	1882	7	1875
New York	314	37	29.86	30.21	+ .13	48.0	+ 2.3	70	17	51	27	30	41	37	41	79	2.12	— 1.7	10	10,410	sw.	52	se.	5	5	9	16	6.8	75	1895	14	1891
Harrisburg	377	9	29.80	30.23	+ .08	47.6	+ 5.2	72	18	56	26	30	40	31	39	77	3.30	+ 0.5	9	5,262	w.	35	w.	5	9	10	11	5.9	77	1876	8	1875
Philadelphia	117	26	30.10	30.23	+ .12	50.4	+ 5.3	73	*	58	28	30	42	36	42	75	2.50	— 0.7	9	7,097	sw.	36	se.	5	10	11	9	5.4	.....	.....	.....	.....
Atlantic City	53	...	30.17	30.22	+ .12	50.2	+ 4.3	70	19	56	29	30	42	36	42	85	1.98	— 1.5	8	8,864	sw.	34	se.	5	10	11	11	6.3	78	1879	15	1880
Baltimore	123	26	30.09	30.22	+ .10	51.0	+ 3.9	75	17	61	29	30	45	33	45	70	3.34	+ 0.3	11	3,132	sw.	22	w.	13	5	14	11	5.6	80	1879	12	1880
Washington	112	37	30.12	30.24	+ .11	50.6	+ 4.2	77	17	61	30	30	42	30	40	70	2.54	— 0.3	12	4,818	s.	30	nw.	13	9	8	13	5.6	80	1879	24	1880
Cape Henry		23				52.2	+ 4.0	77	18	63	34	30	48	38	48	80	2.21	— 1.7	9	.....	se.	.....	.....	9	.....	.....	.....	.....	.....	.....	1890	13	1880
Lynchburg	685	26	29.51	30.26	+ .12	56.8	+ 4.6	79	17	66	34	30	48	38	48	73	4.92	+ 2.0	10	2,780	sw.	27	nw.	13	11	8	11	5.4	81	*	20	1872
Norfolk	57	26	30.30	30.36	+ .14	56.8	+ 4.5	76	19	66	38	30	46	37	45	75	2.41	— 0.7	9	6,346	sw.	42	nw.	13	7	10	5.0	80	*	20	1872
S. Atlantic States.						60.6	+ 4.5								45	75	3.28	+ 0.4											
Charlotte	778	19	29.40	30.23	+ .09	55.6	+ 4.2	73	*	65	33	30	46	37	45	75	3.67	+ 0.6	7	4,978	s.	26	sw.	5	11	10	9	5.0	80	1879	18	1880
Hatteras	11	16	30.24	30.25	+ .14	61.2	+ 5.0	75	11	66	40	14	56	18	56	88	3.86	— 1.3	10	8,876	ne.	44	nw.	13	7	13	10	5.5	79	1882	28	*
Kittyhawk	9	22																												80	1888	23	1879
Raleigh	375	10	29.85	30.36	+ .09	55.3	+ 5.5	79	12	66	29	30	45	31	45	77	2.50	+ 0.3	7	4,400	sw.	24	ne.	29	14	9	7	4.7	80	1889	20	1872
Wilmington	78	26	30.17	30.36	+ .13	60.2	+ 4.0	80	11	70	33	30	51	29	52	84	3.52	+ 1.1	5	5,372	n.	32	sw.	5	15	9	6	4.0	83	*	28	*
Charleston	52	26	30.20	30.25	+ .12	63.1	+ 4.2	80	11	70	40	30	56	26	55	84	1.77	— 1.2	10	5,296	ne.	28	n.	30	11	12	7	4.8	82	*	21	1892
Columbia		10				59.3	+ 4.4	82	11	70	33	15	49	37			3.53	+ 1.0	8	.....	.....			30	10	10	10	.....	83	1895	23	1892
Augusta	180	25	30.03	30.23	+ .10	59.8	+ 4.4	82	11	70	34	9	49	35	51	83	3.74	+ 0.7	8	3,647	ne.	25	se.	27	13	8	9	4.7	85	1885	23	1892
Savannah	98	26	30.13	30.34	+ .09	63.4	+ 4.2	83	11	72	40	9	54	37	55	86	2.42	— 0.1	7	5,357	ne.	27	ne.	23	15	5	10	5.0	83	*	22	1872
Jacksonville	43	26	30.14	30.30	+ .08	67.4	+ 4.2	85	11	75	45	30	60	27	61	88	4.55	+ 2.0	14	5,125	ne.	25	s.	4	9	10	11	5.6	86	1889	26	1887
Florida Peninsula.						74.3	+ 3.6										3.23	+ 0.7											
Jupiter	28	9	30.11	30.14	+ .04	75.5	+ 3.3	84	5	80	64	9	72	14	66	76	2.40	— 1.0	14	9,705	e.	36	n.	13	3	21	6	6.0	87	1889	43	1888
Key West	22	27	30.07	30.09	+ .09	77.0	+ 2.8	86	11	81	69	*	73	13	70	80	3.47	+ 1.2	18	9,448	e.	37	ne.	14	7	15	8	5.4	91	1876	52	1873
Tampa	36	7	30.12	30.16	+ .05	72.0	+ 5.4	85	2	80	53	14	64	23	64	83	3.96	+ 2.0	7	4,980	ne.	20	ne.	14	16	13	1	3.6	87	1892	34	1891
East Gulf States.						62.2	+ 3.4								47	79	2.48	— 0.3											
Atlanta	1,131	19	29.03	30.24	+ .07	55.6	+ 3.8	77	11	64	27	9	48	26	46	82	5.90	+ 2.4	12	6,713	e.	28	nw.	13	15	4	11	5.0	82	1890	16	1887
Pensacola	56	18	30.11	30.17	+ .04	63.3	+ 2.9	81	11	70	34	30	57	26	56	83	4.59	+ 0.8	8	7,555	ne.	30	n.	30	11	7	12	5.4	81	*	28	*
Mobile	57	26	30.14	30.20	+ .06	62.0	+ 3.3	80	12	70	33	30	54	33	55	83	2.86	— 1.0	12	5,696	n.	34	n.	30	9	10	11	5.8	83	1888	25	1887
Montgomery	221	25	29.96	30.20	+ .04	59.4	+ 2.7	85	11	69	32	30	50	33	50	78	2.67	— 0.7	9	4,731	e.	24	s.	11	14	8	8	4.6	85	1896	21	*
Vicksburg	254	26	29.88	30.14	— .02	59.8	+ 2.4	86	11	70	27	30	50	32	51	79	2.64	— 2.2	7	6,022	se.	32	s.	26	18	7	5	3.3	86	1896	22	1891
New Orleans	54	26	30.09	30.15	+ .08	65.2	+ 3.5	84	11	73	35	30	58	30	58	84	2.82	— 1.4	10	7,588	ne.	32	n.	29	6	10	14	6.4	85	1888	30	1891
Port Eads		11				69.8	+ 3.0	80	4	75	42	30	65	24			2.87	— 0.2	7	.....	e.				3	7	20	.....	.....	.....	.....	.....	.....
West Gulf States.						59.2	+ 1.4								50	78	1.77	— 2.2											
Shreveport	249	26	29.87	30.14	— .00	58.7	+ 2.0	86	11	68	29	30	49	35	42	75	1.08	— 3.7	7	6,217	se.	36	se.	26	10	9	11	5.3	86	*	18	1880
Fort Smith	481	15	29.62	30.14	+ .02	51.4	+ 0.0	79	18	62	21	30	44	35	42	77	2.81	— 0.9	6	5,930	e.	40	w.	26	11	4	15	5.9	86	1882	17	1887
Little Rock	302	18	29.86	30.19	+ .05	53.2	+ 0.5	78	18	62	30	30	59	33	60	87	3.81	— 1.5	9	6,072	s.	30	nw.	4	10	5	15	6.0	83	1882	10	1880
Corpus Christi	20	10	30.08	30.10	— .02	64.8	+ 1.1	90	26	70	35	30	60	30	60	84	0.30	— 2.7	6	8,408	se.	34	se.	25	9	12	9	5.4	86	*	30	1896
Galveston	42	26	30.09	30.13	+ .01	65.2	+ 1.5	79	10	68	38	29	51	27	49	75	1.94	— 2.5	6	9,522	se.	39	ne.	10	7	11	12	6.3	87	1888	29	1880
Palestine	510	15	29.60	30.15	— .00	59.2	+ 1.8	83	1	70	32	28	54	33	50	71	1.67	— 2.8	6	5,665	s.	28	s.	3	6	16	8	5.7	88	*	20	1887
San Antonio	704	18	29.38	30.13	— .00	62.0	+ 3.0	84	26	70	32	28	54	33	50	71	0.79	— 1.3	3	6,591	se.	28	se.	3	6	16	8	5.7	88	*	21	1880
Ohio Val. & Tenn.						49.3	+ 2.7								44	76	4.47	+ 0.8											
Chattanooga	702	18	29.43	30.25	+ .09	54.2	+ 3.0	76	19	64	28	9	45	33	43	78	5.51	+ 1.6	13	4,899	s.	30	w.	11	10	7	13	6.0	79	1890	16	1887
Knoxville	980	26	29.18	30.24	+ .06	52.6	+ 4.2	77	18	62	26	30	42	31	42	74	4.32	+ 0.5	10	2,985	ne.	34	sw.	27	13	4	13	5.5	80	1881	12	1872
Memphis	399	26	29.76	30.30	+ .06	53.2	+ 0.8	76	18	62	19	30	44	38	42	72	7.47	+ 2.8	8	8,291	se.	38	se.	10	9	7	14	5.8	82	1879	16	*
Nashville	545	26	29.63	30.32	+ .09	51.8	+ 1.6	75	1	61	18	30	43	35	41	74	5.71	+ 1.9	8	6,260	se.	37	se.	26	12	5	13	5.4	81	1882	10	1887
Lexington	989	14	29.12	30.20	+ .09	47.6	+ 1.5	72	25	60	14	30	40	34	37	71	4.30	+ 0.3	11	10,183	sw.	48	w.	26	6	5	19	6.3	78	1895	6	1887
Louisville	535	26	29.68	30.21	+ .08	50.4	+ 2.3	75	17	58	15	30	41	32	37	68	4.92	+ 0.6	11	5,887	s.	39	se.	26	6	5	19	6.9	79	1895	4	1872
Indianapolis	823	26	29.29	30.19	+ .08	44.6	+ 2.2	71	2	56	10	30	37	36	35	69	4.19	+ 0.3	15	6,042	se.	33	sw.	5	8	8	14	6.4	78	1888	— 5	1880
Cincinnati	668	26	29.58	30.22	+ .10	48.0	+ 2.1	71	2	54	16	30	36	32	37	68	3.29	+ 0.0	11	6,311	sw.	30	sw.	5	8	9	14	6.4	79	1876	4	1880
Columbus	894	19	29.30	30.30	+ .09	45.2	+ 2.8	72	2	54	19	30	41	34	40	77	3.53	+ 0.2	12	5,076	sw.	26	sw.	5	6	7	17	7.0	78	1895	15	*
Pittsburg	842	26	29.29	30.30	+ .09	48.6	+ 4.2	74	26	58	21	30	40	32	41	83	2.76	+ 0.3	11	4,682	se.	25	w.									
Parkersburg	638	9	29.53	30.34	+ .08	48.7	+ 4.6	76	26	58							3.48	+ 0.3	11													
Lower Lake Region.						45.0	+ 2.3								35	73	2.40	— 0.8											
Buffalo	768	26	29.29	30.14	+ .10	42.6	+ 2.7	68	27	49	18	30	36	33	34	74	3.32	— 0.2	17	13,745	w.	72	w.	6	2	8	20	7.9	70	*	2	1875
Oswego	335	27	29.75	30.13	+ .08	42.8	+ 3.9	70	18	50	18	30	35	29	34	75	3.93	+ 0.6	15	9,199	s.	42	w.	6	3	12	15	7.5	73	1888	1	1875
Rochester	543	27	29.56	30.13	+ .08	42.6	+ 3.7	71	18	50	18	30	36	28	35	75	2.49	— 0.4	18	6,332	sw.	36	sw.	6	3	12	15	7.6	74	1888	6	1880
Erie	714	24	29.37	30.15	+ .10	44.6	+ 2.4	70	26	51	17	30	37	33	35	74	2.90	— 1.2	16	10,397	sw.	44	s.	10	4	10	16	6.9	74	1888	0	1880
Cleveland	762	27	29.31	30.14	+ .08	44.2	+ 3.0	70	*	51	14	30	38	30	36	75	1.59	— 1.3	14	13,047	sw.	41	sw.	18	5	5	20	7.7	76	1888	0	1880
Sandusky	629	20	29.45	30.15	+ .08	44.2	+ 2.0	70	*	50	15	30	35	37	36	82	1.53	— 1.5	11	7,553	sw.	31	sw.	5	5	5	18	7.0	74	1888	5	1880
Toledo	674	26	29.40	30.14	+ .08	42.6	+ 1.4	68	*	48	13	30	33	35	33	76	1.71	— 1.2	14	8,728	sw.	44	sw.	5	6	6	18	7.3	70	1888	0	1880
Detroit	730	26	29.33	30.14	+ .08	40.5	— 0.6	65	*	48	13	30	33	35	33	76	1.72	— 1.0	12	9,250	sw.	52	sw.									
Upper Lake Region.						33.0	— 1.9								30	85	3.55	+ 1.0											
Alpena	609	25	29.38	30.06	+ .04	35.3	+ 0.9	64	16	42	8	30	29	38	30	82	3.44	— 0.6	17	8,326	sw.	37	sw.	27	6	6	18	7.4	67	*	— 4	1880
Grand Haven	628	26	29.38	30.08	+ .05	38.4	— 0.5	65	26	45	14	30	32	35	32	86	3.78	— 0.8	21	9,972	nw.	41	nw.	5	2	4	24	8.6	72	1888	0	1880
Marquette	734	26	29.20	30.00	+ .02	28.7	— 4.5	54	16	35	— 2	30	22	41	24	80	6.44	+ 3.7	19	8,175	w.	44	s.	23	3	4	23	8.1	69	1886	— 9	1875
Port Huron	624	9	29.33	30.03	+ .05	30.4	+ 1.3	66	16	46	15	30	25	28	26	89	4.84	+ 2.3	25	8,055	sw.	52	nw.	5	8	11	11	6.0	69	1895	— 6	1880
Sault Ste. Marie	639	23	29.42	30.13	+ .08	30.2	— 1.0	54	16	36	7	30	24	37	26	79	1.81	— 1.0	13	9,807	sw.	48	sw.	18	0	5	25	9.0	62	1893	— 7	1894
Chicago	594	26	29.22	30.13	+ .07	38.4	— 0.3	70	16	46	6	30	31	44	32	85	4.84	+ 2.3	12	8,760	w.	53	w.	27	7	8	15	6.4	75	1888	— 2	1872
Milwaukee	674	26	29.36	30.11	+ .06	35.8	— 0.4	69	16	43	2	30	28	44	30	85	2.16	— 0.6	12	14,050	w.	53	w.	27	8	3	19	7.0	70	*	—14	1875
Green Bay	673	27	29.36	30.11	+ .06	29.4	— 3.2	61	26	35	— 1	30	24	28	25	83	3.60	+ 1.2	15	6,853	w.	36	sw.	27	5	13	12	6.4	68	1895	—12	1887
Duluth	617	11	29.40	30.10	+ .03	29.4	— 9.8	44	16	37	—20	30	14	33	18	91	3.42	+ 1.8	14	7,724	w.	46	ne.	26	3	9	18	7.7	65	1887	—29	1875
North Dakota.						21.0	— 9.8										2.76	— 2.1											
Moorhead	905	16	29.07	30.17	+ .09	3.0	—19.6										3.09	+ 2.2	14	7,304	nw.	36	s.	22	5	7	18	7.2	72	1887	—26	1896
Bismarck	1,674	23	28.33	30.37	+ .19	10.2	—15.7	32	2	18	—26	29	3	47	7	86	3.10	+ 2.4	14	7,471	nw.	54	nw.	26	6	9	15	6.9	73	1887	—28	1875
Williston	1,875	18	28.09	30.25	+ .17	7.2	—21.7	48	16	15	—22	29	0	43	0	70	2.10	+ 1.6	14	7,022	n.	42	n.	26	6	12	12	6.1	68	1887	—29	1887
Upper Miss. Valley.						6.6	—21.3	38	4	14	—24	30	— 1	37	4	89	2.48	— 0.3											
Minneapolis		7				34.3	— 4.6										3.80	+ 3.2	12	.....	nw.	.....	.....	.....	4	10	16	.....	73	1893	—13	1891
St. Paul	887	27	29.16	30.12	+ .06	22.6	— 9.4	52	16	30	—10	30	15	35	17	82	5.07	+ 4.0	15	5,804	w.	39	sw.	27	2	2	12	6.7	74	*	—24	1875
La Crosse		25				21.8	—10.6	50	16	30	—10	30	15	30			2.66	+ 1.2	9	5,689	w.	26	w.	26	6	7	17	7.1	78	1893	—21	1875
Davenport	599	25	29.44	30.11	+ .02	27.4	— 8.6	69	16	44	— 4	30	19	43			0.68	— 1.4	6	6,730	nw.	34	s.	26	6	4	14	5.9	75	1888	—10	1891
Des Moines	867	19	29.18	30.16	+ .06	35.8	— 3.5	72	16	44	— 2	30	28	40	29	77	1.01	— 0.7	11	6,475	nw.	33	sw.	16	12	4	14	6.8	74	1896	—12	1887
Dubuque	650	34	29.38	30.12	+ .04	32.0	— 6.0	74	16	41	— 2	30	23	44	24	71	1.01	— 0.5	13	4,004	nw.	22	w.	27	8	4	18	6.8	74	1888	— 3	1872
Keokuk	614	26	29.46	30.14	+ .05	35.0	— 4.0	74	16	46	0	30	25	41	26	77	1.60	— 0.5	13	6,938	sw.	39	sw.	26	9	8	13	5.6	79	1888	— 7	1872
Cairo	359	26	29.79	30.13	+ .07	38.2	— 3.1	74	16	46	3	30	30	34	30	77	1.01	— 1.1	7	6,988	sw.	51	s.	26	4	10	16	6.6	80	1882		
						50.1	+ 1.7	77	17	58	16	30	42	37	39	73	4.18	0.0	12	8,339	se.											

TABLE I.—*Climatological data for Weather Bureau Stations, November*, 1896—Continued.

Stations.	Elevation above sea-level, feet.	Length of record, years.	Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Humidity and precipitation.					Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Monthly temperature data since opening station.			
			Mean pressure, 8 a. m. and 8 p. m. +2.	Mean reduced.	Departure from normal.	Mean max. and min. +2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.				Absolute maximum.	Year	Absolute minimum.	Year
Up. Miss. Val.—Con																													
Springfield, Ill.	644	18	29.45	30.16	+ .05	41.0	— 2.2	74	16	49	8	30	33	33	32	75	1.88	— 1.1	9	8,319	s.	38	s.	26	7	5	18	6.8	77	*	4	1887
Hannibal	534	....	29.56	30.15	.....	40.6	.....	76	16	50	6	30	31	39	32	73	1.73	— 0.6	8	8,435	sw.	42	s.	26	9	8	13	5.8	....	.....	....	.....
St. Louis	567	26	29.56	30.18	+ .06	46.2	0.0	78	17	54	13	30	38	40	36	74	3.70	+ 0.6	13	9,497	s.	36	s.	2	8	6	16	6.4	82	1879	5	1872
Missouri Valley.						31.2	— 3.5										1.87	+ 0.3													
Columbia	.....	8	.....	.....	.....	43.1	— 1.7	77	16	54	6	30	32	39	.....	.....	1.61	— 1.3	8	7,962	se.	32	s.	26	8	8	14	6.6	80	1890	5	1891
Kansas City	963	9	29.10	30.16	+ .04	40.5	— 2.8	75	16	50	4	28	31	45	30	70	1.38	— 0.8	5	7,934	nw.	38	sw.	9	12	7	11	5.2	79	1891	4	1896
Springfield, Mo	1,334	10	28.72	30.16	+ .05	44.5	— 1.7	74	17	53	9	30	36	31	35	76	2.09	— 1.4	9	9,252	s.	48	se.	26	7	12	11	5.5	79	*	8	1887
Topeka	.....	10	.....	.....	.....	40.2	— 4.0	75	16	51	3	28	29	43	.....	.....	1.04	— 0.5	7	.....	s.	.....	.....	.....	9	12	9	....	83	1891	— 5	1887
Omaha	1,103	26	28.92	30.15	+ .01	29.9	— 9.1	72	16	39	— 2	30	20	32	21	72	2.02	+ 1.0	6	5,375	nw.	24	n.	18	8	13	9	5.3	80	1887	—14	1887
Sioux City	1,165	8	.....	.....	.....	22.4	—11.9	70	16	31	— 9	30	14	50	.....	.....	2.89	+ 2.2	5	7,913	nw.	36	nw.	18	6	10	14	6.6	74	1890	— 9	*
Pierre	1,460	21	28.54	30.21	+ .10	15.0	—19.2	50	16	21	—16	30	9	32	11	85	1.92	+ 1.5	11	7,059	nw.	39	nw.	26	7	3	20	7.1	80	1891	—27	1887
Huron	1,310	16	28.71	30.22	+ .11	13.6	—17.8	45	16	22	—17	29	6	35	5	69	1.97	+ 1.4	11	9,582	nw.	56	se.	22	5	11	14	6.7	77	1893	—28	1887
Northern Slope.						19.7	—13.2										1.24	+ 0.7													
Havre	2,477	17	27.43	30.27	+ .18	3.8	—27.0	53	4	11	—33	20	—3	24	1	90	1.80	+ 1.2	15	4,997	nw.	35	nw.	22	9	10	11	6.0	72	1894	—33	1896
Miles City	2,372	19	27.52	30.19	+ .06	12.7	—18.6	71	15	30	—25	30	6	48	8	79	1.37	+ 1.0	13	5,068	nw.	30	nw.	5	2	11	17	7.8	73	1891	—25	1896
Helena	4,108	17	25.81	30.25	+ .11	18.4	—14.2	63	15	27	—22	27	10	51	7	66	3.29	+ 2.6	12	4,868	sw.	42	sw.	14	5	11	14	6.5	71	1894	—22	1896
Rapid City	3,260	11	26.60	30.16	+ .02	20.9	—14.9	70	16	30	— 9	*	12	48	13	75	1.09	+ 0.7	10	6,341	sw.	54	sw.	16	3	5	22	7.8	79	1894	— 9	1896
Cheyenne	6,105	26	23.93	30.19	+ .04	30.0	— 5.4	68	16	42	—12	27	18	41	7	47	0.14	— 0.2	4	9,495	w.	43	nw.	8	11	10	9	5.5	75	1891	—20	1875
Lander	5,372	14	24.58	30.18	— .02	25.0	— 2.0	67	15	37	—31	27	13	40	12	64	0.81	0.0	7	3,255	w.	48	sw.	17	10	9	11	5.5	72	1894	—31	1896
North Platte	2,826	23	27.12	30.21	+ .06	27.2	—10.1	78	16	38	—13	28	16	45	17	74	0.16	— 0.2	3	6,518	nw.	32	nw.	20	7	20	3	4.7	81	1887	—25	1887
Middle Slope.						38.7	— 4.2										1.06	+ 0.2													
Denver	5,290	25	24.69	30.17	— .01	35.9	— 4.1	75	16	50	— 9	27	22	46	8	40	0.10	— 0.5	2	5,621	s.	44	w.	5	8	18	4	4.7	76	*	—18	1877
Pueblo	4,713	9	25.25	30.14	+ .01	35.4	— 5.3	81	16	49	—17	29	22	50	12	47	0.34	0.0	4	5,161	nw.	38	nw.	9	11	12	7	4.8	81	*	—17	1896
Concordia	1,398	12	28.61	30.16	+ .02	34.4	— 7.3	75	15	44	0	28	25	39	26	75	1.78	+ 0.9	3	5,512	n.	30	s.	25	11	13	6	4.7	82	*	—15	1887
Dodge City	2,504	23	27.45	30.15	+ .04	38.0	— 4.3	77	15	51	2	29	25	46	24	68	0.34	— 0.2	2	7,393	se.	37	sw.	25	15	9	6	4.1	84	1888	—13	1887
Wichita	1,351	9	28.66	30.14	+ .01	41.8	— 1.7	75	17	52	7	28	32	45	30	71	1.42	+ 0.5	4	7,630	s.	38	nw.	6	13	8	9	4.7	83	1891	7	1896
Oklahoma	1,239	7	28.82	30.17	+ .05	46.6	— 2.7	80	17	57	14	*	36	39	35	71	2.41	+ 0.6	4	8,643	n.	32	n.	6	19	4	7	3.7	86	1891	9	1894
Southern Slope.						47.9	— 1.3										0.36	— 0.5													
Abilene	1,749	12	28.29	30.15	+ .01	53.0	— 0.7	82	10	63	21	*	43	35	40	66	0.38	— 1.0	3	8,785	sw.	40	s.	25	18	7	5	3.4	86	*	13	1887
Amarillo	3,691	5	26.28	30.14	+ .01	42.8	— 1.9	82	17	56	8	27	30	48	26	62	0.35	0.0	4	11,659	s.	56	s.	25	16	8	6	4.0	82	1896	8	1896
Southern Plateau.						54.3	+ 1.6										0.25	— 0.2													
El Paso	3,767	19	26.22	30.07	— .04	55.2	+ 3.1	79	17	69	23	30	42	41	28	44	0.04	— 0.5	1	7,974	nw.	46	sw.	25	17	12	1	2.5	82	1882	11	1880
Santa Fe	6,998	23	23.26	30.11	— .02	39.1	+ 1.0	64	16	50	7	29	29	28	18	48	0.25	— 0.5	5	4,762	ne.	33	sw.	26	21	8	1	3.1	77	1878	—11	1880
Phœnix	1,076	....	28.82	29.96	.....	59.6	+ 2.0	83	16	73	32	28	46	36	40	54	0.64	+ 0.2	1	2,362	w.	20	se.	30	18	9	3	3.1	....	.....	....	.....
Yuma	139	22	29.82	29.97	— .05	63.2	+ 0.5	86	17	76	42	28	50	36	36	42	0.06	— 0.2	1	4,704	n.	38	n.	29	23	6	1	2.0	92	*	31	1880
Middle Plateau.						38.1	— 1.6										1.95	+ 0.8													
Carson City	4,730	9	25.26	30.09	.....	40.4	— 1.3	71	14	52	7	29	29	49	23	55	1.53	0.0	7	.....	sw.	....	.....	.....	7	16	7	5.2	72	*	7	1896
Winnemucca	4,340	18	25.67	30.13	— .07	36.6	— 0.6	68	16	47	— 4	28	26	43	30	54	1.17	+ 0.6	10	7,465	sw.	50	sw.	9	6	5	19	7.2	73	1891	— 9	1880
Salt Lake City	4,344	23	25.66	30.18	— .05	37.2	— 2.8	65	16	46	— 2	29	29	26	27	70	3.15	+ 1.8	11	4,166	se.	39	nw.	9	5	5	20	7.7	72	1891	— 2	1896
Northern Plateau.						30.9	— 5.9										3.28	+ 2.1													
Baker City	3,470	8	26.42	30.06	— .08	30.6	— 6.5	62	15	38	— 8	29	24	29	22	74	1.91	+ 1.0	17	5,532	se.	36	sw.	15	5	12	13	6.3	....	.....	....	.....
Idaho Falls	4,742	7	25.22	30.18	— .03	28.6	— 1.7	60	16	36	—26	28	21	44	22	81	3.25	+ 2.4	14	7,058	s.	40	s.	8	4	6	20	7.5	61	1894	—26	1896
Spokane	1,929	16	27.96	30.09	— .05	30.6	— 6.8	63	14	38	—13	28	24	23	26	84	4.85	+ 3.2	15	5,309	sw.	37	sw.	14	5	8	17	6.9	69	1891	—13	1896
Walla Walla	1,018	11	28.99	30.12	— .07	33.8	— 8.7	71	14	39	— 9	28	28	20	27	79	3.09	+ 1.7	18	5,286	s.	33	s.	14	4	11	15	6.7	76	1891	— 9	1896
N. Pac. Coast Reg.						40.1	— 6.2										12.73	+ 5.3													
Fort Canby	179	14	29.76	29.96	— .09	41.0	— 6.7	54	14	45	20	27	37	14	38	89	15.12	+ 6.6	20	13,948	e.	82	se.	1	6	4	20	7.1	72	1890	20	1896
Port Angeles	29	12	.....	.....	.....	36.9°	— 5.5	53°	*	42°	12°	27	31°	17°	.....	.....	7.48	+ 3.0	16°	4,462	se.°	38°	ne.	25	06	*7	*12	*6.6	61	1887	12	1896
Seattle	119	....	29.87	30.00	.....	38.4	.....	50	14	42	15	27	34	17	34	83	9.50	.....	18	5,019	se.	30	se.	8	7	5	18	6.9	....	.....	....	.....
Tatoosh Island	86	14	29.85	29.95	— .05	39.7	— 6.9	54	14	43	25	26	36	15	34	77	14.16	+ 2.0	23	13,416	e.	50	s.	12	6	1	23	7.7	60	1891	31	1896
Astoria	.....	12	.....	.....	.....	41.6	— 5.9	58	14	46	19	27	37	19	.....	.....	16.56	+ 6.8	19	.....	sw.	.....	.....	.....	7	4	19	....	66	1891	19	1896
Portland, Oreg.	153	26	29.86	30.03	— .07	38.6	— 7.9	60	14	43	11	29	34	25	33	83	13.12	+ 7.3	20	8,794	s.	49	se.	13	6	11	13	6.5	73	1890	11	1896
Roseburg	521	20	29.47	30.05	— .09	42.7	— 4.0	65	14	49	14	28	36	26	37	83	9.91	+ 6.2	19	2,463	sw.	24	s.	21	4	8	18	7.4	74	1891	14	1896
Mid. Pac. C'st Reg.						51.3	— 2.2										4.88	+ 1.8													
Eureka	64	10	30.04	30.10	— .00	49.1	— 1.0	69	14	56	37	27	42	24	43	84	8.00	+ 3.9	20	4,580	e.	34	nw.	24	8	9	13	5.9	74	1895	27	1896
Redbluff	334	19	29.72	30.08	— .03	50.8	— 2.6	67	4	59	27	29	43	27	37	66	3.41	+ 0.3	8	5,245	nw.	33	n.	5	11	6	13	5.5	88	1890	26	1880
Sacramento	71	20	.....	.....	.....	52.6	— 0.8	72	4	62	31	29	44	30	.....	.....	3.56	+ 1.4	8	5,725	.....	.....	.....	.....	13	8	9	5.2	78	*	27	1880
San Francisco	153	26	29.93	30.09	— .01	53.4	— 2.6	66	3	58	38	27	48	17	46	79	4.56	+ 1.9	8	5,701	w.	33	w.	25	13	9	8	4.9	83	1895	38	1896
Point Reyes Light	.....	7	.....	.....	.....	50.6	— 4.0	61	*	54	34	27	47	16	.....	.....	4.85	+ 1.7	8	.....	nw.	.....	.....	.....	10	10	10	.....	.....	.....	.....	.....
S. Pac. Coast Reg.						57.6	— 0.6										1.37	+ 0.3													
Fresno	332	10	29.71	30.07	— .01	53.2	— 2.2	76	16	63	30	29	44	30	44	74	1.46	+ 0.3	6	3,010	nw.	18	nw.	25	18	5	7	4.2	82	*	29	*
Los Angeles	330	20	29.67	30.02	— .02	59.8	— 0.2	84	12	70	37	27	50	30	47	72	1.66	+ 0.3	5	2,816	w.	20	nw.	26	14	12	4	3.8	96	1890	34	1886
San Diego	69	26	29.96	30.04	— .01	59.7	+ 0.5	76	13	67	43	28	52	23	50	76	0.98	+ 0.2	5	3,345	nw.	29	w.	25	23	3	4	2.7	91	1890	38	*
San Luis Obispo	201	....	29.86	30.08	.....	56.8	.....	79	*	68	32	30	45	44	43	69	3.02	.....	7	3,739	n.	24	n.	4	17	6	7	4.1	....	.....	....	.....

NOTE.—The data at stations having no departures are not used in computing the district averages. Letters of the alphabet denote number of days missing from the record. *Two or more directions, dates, or years. †Received too late to be considered in departures, etc.

TABLE II.—*Meteorological record of voluntary and other cooperating observers, November, 1896.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Alco†	94	38	60.3	4.99	
Ashville*†	84	24	55.4	4.78	
Bermuda†	89	28	62.4	2.19	
Birmingham†	84	24	58.4	3.80	
Brewton†	82	28	57.8	3.40	
Bridgeport†				7.84	
Citronelle†	80	30	62.0	4.34	
Clanton†	80	27	56.7	3.22	
Cordova†				3.82	
Daphne†	83	29	60.4	3.62	
Decatur†	80	18	52.0	7.60	
Demopolis†				3.67	
Elba†	84	38	59.6	7.67	
Eufaula c†	80	33	61.4	3.96	
Evergreen†	84	28	59.9	2.84	
Florence a†				5.75	
Florence b†	79	30	54.1	6.27	
Fort Deposit†	87	22	58.5	2.69	
Gadsden	80	26	55.8	4.31	
Goodwater†	84	28	59.3	3.14	
Greensboro†	84	27	57.2	2.92	
Healing Springs†	90	28	58.0	2.09	
Highland Home†	88	32	61.6	5.32	
Livingston	85	26	57.7	4.42	
Lock No. 4				2.61	
Madison Station†	80	19	53.3	3.84	
Marion†	82	27	56.3	3.15	
Mount Willing†	85	30	59.8	3.46	
Newbern†	84	28	58.3	3.80	
Newburg†	83	19	54.4	6.85	
Newton†	85	29	60.2	7.04	
Opelika†	81	30	60.0	5.10	
Oxanna†	80	24	55.2	3.80	
Pineapple†	89	28	59.0	0.54	
Pushmataha†	86	26	58.4	3.17	
Rockmills†	84	31	60.0	3.54	
Scottsboro†d	81	22	53.8	6.10	
Selma†				1.02	
Talladega*†	80	26	55.2		
Tuscaloosa†	88	26	55.7	2.77	
Union†	86	25	56.9	3.56	
Union Springs†	82	30	59.2	6.26	
Uniontown†	84	29	60.0	2.09	
Valleyhead†	78	20	55.4	6.09	
Wetumpka				3.02	
Wilsonville†				3.68	
Arizona.					
Benson*§	83	38	61.8	0.16	
Bisbee†	77	29	55.0	0.40	
Buckeye†	80	32	60.0	0.60	
Calabasas†	77	26	52.3	0.53	
Casa Grande*§	80	42	60.9	0.00	
Congress	77	35	58.4	1.23	
Dragoon†				0.80	
Dragoon Summit*§	65	25	53.6	0.40	
Dudleyville	80	30	54.5	0.39	
Eagle Pass*§		14	41.6	0.82	
Farleys Camp†	82	32	59.6	0.60	
Fort Apache	80	12	45.2	0.77	T.
Fort Grant†	77	22	54.2	0.46	
Fort Huachuca†	75	26	53.0	0.62	
Gilabend a*§	86	37	63.0	T.	
Glendale	82	31	56.8	0.75	
Holbrook†	71	10	43.0	0.02	
Ingleside	85	31	58.4	0.56	
Marlcopa*§	98	41	66.1	3.60	
Mesa†	80	34	57.6	0.85	
Mount Huachuca	72	25	52.8	1.33	
Oracle†	75	30	54.4	0.65	
Oro				0.34	
Oro Blanco	78	33	56.8	0.56	
Pantano*§	75	35	48.6	0.39	
Parker†	86	21	58.3	0.17	
Payson				1.80	
Peoria†	78	35	58.2	1.01	
Phœnix	80	29	56.7	0.95	
Pinal Ranch				2.35	
Reymert†	90	34	63.2	1.21	
San Carlos†	79	27	52.4	0.67	
San Simon*§	83	30	56.5	0.10	
Showlow				0.60	4.0
Signal†	77	30	56.1	0.26	
Sulphur Spring Valley†				0.28	
Texas Hill*§	83	30	57.4	0.00	
Tucson c†	83	30	58.1	0.30	
Walnut Ranch*†‖	70	28	49.3	0.29	
Whipple Barracks†	71	14	43.8	0.99	
Willcox*§	68	27	51.4	0.30	
Arkansas.					
Arkansas City†				9.51	
Beebranch†5	80	17	51.4	4.85	
Blanchard Springs†	85	27	57.2	7.13	
Camden a†				2.51	
Camden b†	83	21	54.6	2.45	
Canton*‖	76	18	50.4		
Conway*6	77	21	52.7	4.93	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Arkansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Corning†	79	13	47.8	3.89	T.
Dallas	76	21	52.9	4.40	
Elon†	88	25	58.6	6.97	
Emmet*‖	77	28	55.2	1.00	
Fayetteville†	80	12	50.0	3.00	1.0
Fulton†				1.26	
Helena a†				6.94	
Hot Springs b				2.81	
Hot Springs (near)				2.88	
Keesees Ferry†	81	8	49.8	2.34	T.
Lacrosse†	78*	10*	45.8*	4.74	
Lonoke*†	78	22	53.6	3.11	
Luna Landing*§	82	25	58.0	7.11	
Lutherville*†	76	19	51.9		
Malvern†	80	22	54.0	4.29	
Marianna*†	80	24	55.5		
Marvell	80	22	55.8	3.80	
Moore				6.70	
Mossville	71	11	47.1	2.86	
Mount Nebo†	74	17	49.6	3.15	
New Gascony*‖	76f	23*	52.4*	4.77	
Newport a†				5.03	
Newport c†	78	19	51.7	5.17	
Oregon*‖	82	11	46.0		
Osceola†	80	18	52.0	6.45	1.0
Ozark†	79	19	53.8	2.28	
Picayune†		25		4.45	T.
Pinebluff†	81	23	56.8	3.64	
Pocahontas†	78			3.42	
Prescott†	81	30	58.0	2.31	
Rison†	80	26	56.1	2.54	
Silver Springs†	76	10	46.6	2.88	0.6
Stuttgart†	79	22	52.5	7.70	
Texarkana†	85	27	59.4	1.46	
Warren†	81	25	55.0	4.03	
Washington*†‖	79	28	55.7	1.42	
Wiggs*‖	78	23	55.8	3.04	
Witts Springs†	74	10	47.4	3.69	
California.					
Adin	61	4	36.2	5.36	8.0
Agnew	70	28	50.0	3.33	
Arlington Heights	84	34	57.6	1.45	
Asti	68	50	57.2		
Athlone*§	74	27	54.4	1.78	
Azusa				1.08	
Ballast Point L. H				0.62	
Barstow†	77	26	51.9	0.25	
Bear Valley†				18.35	T.
Berkeley	65	34	51.2	5.15	
Bishop†	69f	10f	44.1f	0.04	
Bishop Creek*§	70	19	46.8	T.	
Boca*§	68	5	37.6	2.47	1.0
Bodie†	56	−17	30.4	0.94	7.0
Bowmans Dam†				19.40	15.0
Caliente*§	69	36	54.0	1.02	
Calloway Canal†				0.30	
Cape Mendocino L. H				6.37	
Castle Pinckney	78	42	58.2	2.83	
Cedarville†	64	−6	33.4	5.76	16.0
Centerville*‖	74	39	55.2	6.16	
Chico*§	76	26	52.7	5.52	
Chino*†6	79	35	55.1	1.71	
Cisco*§	53	10	34.6		23.0
Claremont†	76	31	55.6	1.17	
Corning*§	73	28	50.6	3.08	
Coronado	84	49	65.6	0.98	
Craftonville	76	27	54.2	1.60	
Crescent City†	58	26	46.7	15.02	
Crescent City L. H				16.25	
Delano*§	77	31	50.4	0.62	
Descanso*§	72	30	50.0	2.12	
Drytown	69	28	48.7	6.62	
Dunnigan*§	72	30	53.3	3.65	
Durham*‖	64	24	44.5	5.44	
East Brother L. H				4.45	
Edgwood*§	60	8	38.8	3.45	8.0
Edmanton*†‖	62	12	37.7	16.64	6.0
Escondido	70	28	54.8		
Fallbrook*‖	81	37	55.4	1.22	
Famosa†	67	33	50.8	0.69	
Folsom City b*‖	73	30	51.4	6.55	
Fordyce Dam†				16.97	53.0
Fort Bragg†				7.61	
Fort Ross				14.65	
Georgetown†	66	24	46.4	17.18	
Glendora				1.46	
Goshen*§	76	27	49.9	1.00	
Grand Island*§	72	30	52.6	3.34	
Grass Valley				13.65	
Greenville†	67	6	39.2	9.48	1.0
Guinda				2.85	
Healdsburg*‖	76	26	54.8	8.56	
Hollister	74	24	51.4	1.91	
Hueneme				2.09	
Humboldt L. H				7.26	
Hydesville†	68	25	49.2	8.19	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Indio*§	80	39	59.5	0.00	
Iowa Hill*‖	68	26	47.1	13.42	
Isabella*§	70	24	50.6	0.48	
Jolon				3.20	
Keeler*§	80	28	51.4	0.00	
Keene*§	87	28	49.4	0.86	
Kennedy Gold Mine	70	28	49.3	10.71	
King City*§	74	32	59.4	1.92	
Kingsburg*§	75	28	52.0	0.67	
Kono Tayee	64	29	49.4	3.33	
Lagrange*§	70	27	53.8	3.73	
Laporte*†‖	55	12	36.0	23.87	12.0
Lemoore a*§	76	27	51.1	1.40	
Lick Observatory†	67	18	44.7	5.86	1.0
Lime Kiln	84	30	55.0		
Lime Point L. H				5.29	
Lodi	72	27	51.8	3.86	
Los Alamos†				1.20	
Los Gatos b	66	31	50.8	6.26	
McMullin*‖	78	30	54.1		
Malakoff Mine*‖	64	24	45.6	17.42	
Mammoth Tank*§	85	40	63.7	T.	
Manzana	69	30	45.9	0.30	
Mare Island L. H				5.10	
Merced*§	78	33	54.5	1.94	
Middletown*†‖	69	25	46.3	7.55	
Mills College				6.07	
Modesto*§	73	32	58.2	2.97	
Mohave*§	76	25	52.0	0.17	
Mokelumne Hill*§		31	48.2	8.98	T.
Monterey*§	70	36	53.5	2.13	
Mount Glenwood*‖	70	32	52.9	3.95	
Mutah Flat†				1.50	
Napa b	74	28	50.1	5.03	
Needles	84	30	62.0	T.	
Nevada City†	64	22	44.8	12.63	
Newcastle a†	69	29	49.0	8.16	
Newhall*§	81	28	60.1	1.00	
Nordhoff†	88	25	56.6	1.03	
North San Juan*‖	73	22	46.9	12.80	
Oakland a	66	33	51.0	6.11	
Ogilby*§	85	54	69.4	0.00	
Oleta*‖	69	27	46.6	8.05	
Orangevale†	71	27	53.1	6.29	
Orland*§	69	28	52.0	2.69	
Oroville b	78	28	57.4	6.30	
Palermo†	81	27	49.6	5.83	
Peachland*‖	68	26	50.1	5.53	
Picachot	83	42	64.3	0.01	
Piedras Blancas L. H				5.37	
Pigeon Point L. H				5.16	
Pilot Creek				15.74	T.
Placerville	66	21	44.9	11.71	
Point Ano Nuevo L. H				4.23	
Point Arena L. H				7.07	
Point Bonita L. H				6.43	
Point Conception L. H				1.82	
Point Fermin L. H				3.43	
Point George L. H				5.22	
Point Hueneme L. H				2.42	
Point Lobos	61	38	51.3	4.99	
Point Loma L. H				0.39	
Point Montara L. H				5.46	
Point Pinos L. H				3.54	
Point Reyes L. H				4.58	
Point Sur L. H				4.50	
Pomona (near)	81	32	57.4	1.19	
Poway*§	83	38	51.4	1.54	
Quincy†	63	13	39.6	11.26	T.
Ravenna*§	74	37	54.0	T.	
Redding b†	66	27	49.2	6.30	T.
Reedley (near)*‖	75	30	53.4	0.95	
Represa	72	28	52.0	5.86	
Riovista	70	27	51.5	3.12	
Roe Island L. H				3.90	
Roseville (near)*§	70	26	47.6	6.21	
Rosewood	69	15	46.8	3.68	
Sacramento a	71	28	51.1	4.20	
Salinas*§	68	32	51.1	2.64	
Salton*§	89	47	70.8	0.46	
San Bernardino†	80	31	56.0	0.96	
San Jacinto	79	29	54.0	1.20	
San Jose b	69	22	48.4	2.82	
San Leandro*‖	76	38	55.4	5.78	
San Luis L. H				3.10	
San Mateo*§	64	38	53.6	4.87	
San Miguel*§	72	28	50.6	1.49	
Santa Ana*§	76	38	58.8	1.45	
Santa Barbara a	70	40	58.7	3.51	
Santa Barbara L. H				2.55	
Santa Clara a*§	70	32	51.3	3.13	
Santa Cruz b†	73	30	52.6	6.79	
Santa Cruz L. H				6.34	
Santa Maria	82	39	59.0	1.92	
Santa Monica*§	75	49	64.2	2.23	
Santa Paula b†	80	32	56.0	1.43	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	In	Ins.
Santa Rosa *§	70	28	51.0	5.09	
Saticoy				1.68	
Shasta				10.17	
Sierra Madre	78	37	58.2	1.48	
Sneddens Ranch †				1.35	2.0
S. E. Farallone L. H				3.36	
Stanford University	72	30	51.8	2.74	
Stockton *a*	71	29	50.9	2.30	
Summerdale †	61	14	40.0	9.66	3.0
Susanville †	83	18	48.2	3.88	4.0
Sutter Creek *§	65	22	43.8	6.00	
Tehama *§	70	34	53.6	2.90	
Templeton *§	74	30	51.4	1.73	
Trinidad L. H				6.87	
Truckee *§	60	2	35.8	3.86	3.5
Tulare *b*				1.28	
Tulare *c*	84	27	53.4	1.11	
Turlock *b* †	74	25	51.8	1.92	
Ukiah †	68	30	47.2	7.00	
Upper Mattole *‡	68	30	48.2	13.44	
Vacaville *a* †	74	32	52.6	6.23	
Ventura †	80	31	55.8	1.50	
Volcano Springs *§	91	39	65.2	0.00	
Walnutcreek	76	30	52.6	3.43	
West Palmdale				0.43	
Westpoint †				9.30	
Wheatland †	70	26	49.6	4.91	
Williams *§	75	32	51.9	2.14	
Wilmington *§	75	45	64.0		
Wire Bridge *§	69	25	50.4	8.75	
Yerba Buena L. H				3.60	
Yreka †	66	1	38.2	5.02	6.0
Yuba City *§	69	38	58.4	5.43	
Engineers Quarters ‡				1.38	
Morses House ‡				1.96	
Deep Creek ‡				1.65	
Holcomb Creek ‡				1.05	
Squirrel Inn ‡				1.60	
Colorado.					
Alma †	52	−18	22.6	0.77	
Antlers †	58	− 2	32.4	0.93	
Arkins				0.08	1.0
Boxelder				0.27	
Breckenridge †	63	−25	20.4	3.87	38.7
Canyon †	77	−13	36.5	0.44	6.0
Castlerock †	63	−13	32.2	0.32	3.2
Colorado Springs †	72	−10	34.0	0.03	0.5
Cope †	74	−12	33.0	0.20	2.0
Cripple Creek †	74	− 6	36.6	0.42	6.0
Denver					0.9
Downing †	76	− 6	38.9	0.80	8.0
Dumont *† §	60	− 4	33.6	0.50	5.0
Durango †	61	− 1	35.4	1.08	6.0
Fleming				0.40	4.0
Fort Collins †	75	−11	30.6	0.05	0.3
Fox				0.01	0.5
Garnett				0.00	0.0
Gleneyrie †	67	− 9	34.3	0.24	
Grand Junction †	62	7	38.6	0.49	4.0
Greeley †	73	−15	28.4	0.02	0.2
Gulch †	52	− 5	27.8	1.73	23.0
Gunnison †	49	−19	19.6	0.90	9.0
Holly				0.20	T.
Hugo (near)	74	−14	30.4	0.02	0.5
Husted †	74	−14	36.4	0.20	3.2
Lake Moraine †	55	− 9	26.2	0.45	5.0
Lamar † [f]	81	− 2	36.6	0.00	0.0
Laporte				0.01	T.
Las Animas †	80	− 2	37.2	0.00	0.0
Lay †	56	−22	26.2	1.47	14.5
Leadville (near) *† ‡	55	− 7	22.7	0.95	21.2
Leroy †	68	−12	29.5	0.20	2.0
Longmont †	74	− 9	31.6	0.00	0.0
Longs Peak	62	− 9	28.0	0.37	3.8
Loveland				0.04	0.5
Meeker †	58	−22	27.8	1.43	15.4
Millbrook †	71	−10	33.5	0.40	4.5
Minneapolis †	83	1	38.6	0.43	0.0
Montrose †	65	1	34.9	0.38	2.5
Moraine †	57	− 6	31.1	0.30	3.5
Pagoda †	59	−21	26.0	1.30	14.5
Paonia †				0.55	5.5
Parachute †	61	2	32.1	0.86	2.8
Pinkhamton *§	54	−10	27.4	0.56	6.0
Pueblo					3.6
Rangely †	58	− 8	28.4	0.15	1.5
Redcliff				2.32	23.4
Rico †	57	−19	26.8	2.40	24.0
Rockyford †	81	− 5	36.2	0.00	0.0
Ruby				9.30	93.0
Saguache †	55	− 7	28.6	T.	T.
St. Cloud				0.01	0.5
San Luis †	61	−10	31.0	0.24	2.3
Santa Clara *‡	55	− 8	29.4	0.90	9.0
Seibert †				T.	T.
Sherwood Ranch	56	−19	26.2		

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Colorado—Cont'd.	°	°	°	Ins.	Ins.
Smoky Hill Mine †	72	−14	32.6	0.30	3.0
Stamford *‡	52	− 6	26.8	0.93	9.5
Steamboat Springs †	58 [e]	−25	31.6 [e]	1.81	18.5
Sulphur Springs †	56	−25	21.6	1.10	11.0
Surface Creek †	66	0	36.2	0.16	1.0
Thon †	73	−12	35.4	0.05	3.0
T. S. Ranch †	63	3	37.2	0.40	1.5
Twin Lakes				2.43	22.0
Vilas				0.32	
Wallet †				T.	T.
Wray †	82	−14	30.6	0.06	0.5
Yuma				0.30	3.0
Connecticut.					
Bridgeport	70	23	45.6	3.02	5.5
Canton †	72	12	44.1	3.15	1.5
Colchester	72	12	43.3 [b]	3.42	4.0
Falls Village				2.80	1.5
Greenfield Hill				2.84	4.8
Hartford *b*				2.33	2.0
Hartford *c*	69	24	46.0		2.0
Lake Konomoc				3.55	
Middletown	73	19	45.8	3.04	4.0
New Haven	[e]				6.1
New London †	68	23	46.5	2.28	3.2
North Grosvenor Dale	69	14	41.6	3.22	0.5
Norwalk	69	18	44.0	2.41	4.5
Southington *‡	71	18	43.7	3.10	3.0
South Manchester				2.30	2.0
Storrs	69	17	43.7	2.49	3.0
Voluntown †	71	16	46.2	4.17	5.0
Wallingford †				2.73	5.0
Waterbury	68	27	46.4	3.09	3.0
West Cornwall †	72	18	42.4	2.98	1.5
West Simsbury				2.93	1.5
Windsor	68	18	43.6	2.30	1.9
Delaware.					
Dover †	74	30	50.8	2.15	0.5
Milford	78	30	54.2	2.47	0.5
Millsboro	78	26	53.9	2.04	2.0
Newark	73	25	48.5	2.95	3.0
Seaford †	74	28	51.2	2.06	1.5
Wilmington †	74	29	51.3	2.93	3.0
District of Columbia.					
Distributing Reservoir *§	74	29	51.2	1.68	
Receiving Reservoir *§	73	29	50.6	2.44	
Washington					2.5
West Washington	77	26	50.2	2.84	3.0
Florida.					
Amelia †	81	49	67.0	4.42	
Archer †	87	44	68.8	4.72	
Bartow	88	53	71.9	0.97	
Brooksville †	83	50	70.3	2.89	
Carrabelle †	81	41	68.4	2.20	
Clermont †	88	56	74.6	1.81	
De Funiak Springs	82	35	62.0	9.80	
Earnestville †	86	46	70.0	2.51	
Emerson †	87	43	67.5	4.70	
Eustis †	86	49	71.0	2.59	
Federal Point †	84	49	68.5	4.44	
Fort Meade †	88	50	70.9	1.27	
Frostproof *† ‡	89	57	71.9	0.64	
Grasmere †	86	52	70.8	3.20	
Huntington	84	51	70.2	2.03	
Kissimmee †	85	52	73.2	3.23	
Lake Butler †				4.30	
Lake City † ‡	83	45	66.9	5.54	
Lemon City †	88	66	77.4	1.00	
Macclenny †	87	42	66.6	3.69	
Manatee †	88	51	71.8		
Merritts Island †	85	64	74.2	2.22	
Mullet Key †	83	59	72.3	1.38	
Myers †	87	60	73.6	1.26	
New Smyrna †	84	54	70.7	4.97	
Oakhill *‡	87	67	75.9		
Ocala *† ‡	85	51	69.1	3.67	
Orange City	86	52	70.6	3.65	
Orange Park	90	41	67.8	7.17	
Orlando †	84	53	69.4	3.53	
Oxford *† ‡	83	55	70.2	2.50	
Plant City †	90	50	72.4	0.94	
St. Francis †	86	45	68.4	1.59	
St. Francis Barracks	82	49	69.8	3.42	
Tallahassee †	80	38	62.6	8.60	
Tarpon Springs †	88	50	71.6	5.18	
Georgia.					
Adairsville †	76	27	53.8	4.34	
Albany †	80	32	58.0	2.18	
Allentown †	79	32	60.6	7.49	
Americus †	80	31	60.2	6.41	
Blakely *† ‡	82	34	61.9	5.43	
Brag †	86	29	62.2	2.46	
Canton †				6.39	
Cedartown	78	25	54.0	4.58	
Clayton †	71	24	51.6	11.89	
Covington	75	27	54.4	9.78	
Dahlonega †	76	24	54.4	7.86	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Georgia—Cont'd.	°	°	°	Ins.	Ins.
Diamond †	70	22	51.2	9.17	
Dublin				5.85	
Elberton †	78	30	56.0	5.61	
Fleming †	85	31	61.4	5.63	
Fort Gaines	79	32	59.2	3.78	
Gainesville	77	26	53.2	6 77	
Gillsville †	78	31	56.4	6.13	
Hephzibah *† ‡	76	40	62.3	4.15	
Lagrange †	80	29	58.4	7.15	
Louisville †	84	30	59.8	2.86	
Macon † *b*				7.09	
Marietta †	76	27	54.2	4.94	
Marshallville †	80	32	60.1	8.78	
Milledgeville †	77	30	58.2	7.25	
Millen †	80	30	57.2	3.02	
Monticello *† ‡	75	39	58.6	5.15	
Morgan †	82	28	59.8	4.37	
Newnan †	80	28	56.7	7.13	
Piscola	83	40	64.6	5.35	
Point Peter *‡	72	28	55.5	6.60	
Poulan †	84	32	61.4	5.82	
Quitman †	82	34	63.0	4.54	
Ramsey †	76	22	56.2	6.88	
Resaca †				5.49	
Rome †	74	27	53.9	4.96	
Talbotton †	79	30	57.4	8.46	
Tallapoosa	76	29	55.7	4.43	
Thomasville †	83	37	63.6	7.81	
Toccoa †	71	33	55.1	8.22	
Washington †				6.35	
Idaho.					
American Falls	61	−27	29.7	3.88	8.0
Blackfoot †	63	−28	34.0	2.17	1.5
Boise Barracks †	67	−10	35.6	3.26	13.5
Burnside †	51	−24	21.9	0.73	5.0
Chesterfield †	50	−26	34.0	3.22	6.0
Cœur d'Alene	60	−13	30.6		
Corral *† ‡	45	−31	33.8	4.25	16.0
Fort Sherman †	61	−15	29.7	9.13	21.2
Gimlet †	54	−24	25.6	6.11	37.5
Grangeville	57	−11	29.0	3.23	12.7
Idaho City	52	−18	28.8	5.96	19.0
Idaho Falls					14.9
Kootenai †	57	−14	27.6	5.32	40.0
Lake †	90	−31	19.0	3.40	34.0
Lewiston *a* †	67 [a]	0 [a]	38.0 [a]	2.19 [a]	12.5
Lost River †				2.31	13.0
Martin †	55	−32	23.6	4.10	20.0
Minidoka †	65	−33	28.8	3.35	10.2
Moscow †	56 [f]	−14 [f]	30.6 [f]	5.52	14.2
Murray †	55	− 8	26.8	11.12	30.0
Nampa	69	−16	29.5	2.08	8.0
Oakley	60	−14	33.8	1.54	4.0
Ola †	60	−12	32.8	4.48	9.7
Paris †	60	−13	28.6	2.17	8.0
Payette †	80	− 6	43.0	2.05	12.5
Pollock †	62	−13	36.0	1.41	2.5
Rexburg †	57	−34	28.4	2.94	
Roseberry †	56	−34	23.6	3.47	17.0
Salubria †	57	−11	32.2	4.60	30.9
Soldier †	54	−33	24.0	4.82	20.5
Swan Valley †	54	−34	25.6	1.98	16.0
Warren †	50	−38	25.2	4.82	
Yellowjacket †				4.46	
Illinois.					
Albion †	75	10	46.6	3.35	T.
Alexander †	78	5	42.6	1.09	4.0
Ashton *† ‡	70	0	35.2	2.32	10.0
Atlanta				2.32	8.0
Atwood *a* *† ‡	76	4	39.2	2.93	6.0
Atwood *b*				2.28	
Aurora *b* †	71	2	36.1	4.10	11.2
Beardstown †				1.25	2.0
Bloomington †	78	3	40.6	2.05	7.3
Bushnell †	75	3	38.8	1.67	2.0
Cambridge	70	2	36.1	1.21	4.0
Carlinville †	78	8	43.2	2.01	4.0
Carlyle				5.31	3.0
Carrollton	74	6	40.3	1.50	2.2
Catlin				6.60	2.0
Charleston	73	8	42.6	3.82	5.5
Chemung *‡	67	1	34.1	2.58	10.0
Chicago					4.2
Cisne *† ‡	79	9	45.0	3.98	1.0
Clearcreek †	74	2	35.6	2.75	7.0
Coatsburg †	77	3	40.2	1.82	T.
Cobden †	78	12	48.1	3.75	T.
Decatur †	75	6	42.5	2.81	6.0
Dixon †	73	2	35.8	1.70	7.0
Dwight †	73	1	36.7	3.54	10.0
East Peoria †	72 [f]	3 [e]	36.7 [e]	3.18	6.0
Effingham †	75	10	44.8	3.38	3.8
Fort Sheridan †	69	6	37.5	2.80	4.5
Friendgrove *† ‡		16	46.8	3.89	0.0
Galva †	72	0	36.2	1.42	5.8
Glenwood *† ‡	68 [e]	1	35.4 [e]	2.63	6.0

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Illinois—Cont'd.	°	°	°	*Ins.*	*Ins.*
Golconda†	77	13	49.8	4.38	T.
Grafton†				1.02	
Greenville†	78	9	42.9	5.36	5.0
Griggsville†	76	6	42.4	1.65	
Halliday*[3]	77[e]	14[e]	47.5[e]	3.14	T.
Havana†	75	6	42.2	1.84	3.0
Herrin*[1]	74	16	49.0	1.91	0.3
Hillsboro†	75	9	43.8	2.58	4.5
Iron†	76	13	48.8	3.36	0.0
Joliet†	73	6	40.6	2.96	10.5
Jordans Grove†	79	13	46.9	3.43	3.3
Kankakee*a†	69[b]	8[b]	37.0[f]	1.95	4.0
Knoxville*a*[5]	72	— 1	37.2	2.30	4.5
Lagrange†	70	6	37.8	3.08	7.0
Laharpe*[1]	78	— 2	38.0	2.53	T.
Lanark*†[1]	69	0	33.6	0.83	
Loami†				1.63	5.0
Louisville†	76	10	45.9	3.92	2.5
McLeansboro†	76	12	48.0	2.39	T.
Martinsville†	75	9	44.0	3.27	3.0
Martinton†	75	8	39.8	1.98	3.5
Mascoutah*[5]	80	10	45.8	4.20	2.2
Mattoon*[1]	68	12	43.8	2.81	5.2
Minonk†	74	3	38.7	2.33	8.5
Monmouth†	73	1	37.6	0.81	1.3
Morrisonville†	75	6	42.8	2.59	6.2
Mount Carmel†				3.34	T.
Mount Pulaski	75	6	42.0	1.95	5.0
Mount Vernon	80	11	47.5	3.10	2.5
New Burnside†	77	11	49.2	3.14	
Olney*a*[1]	75	10	47.1	5.56	4.4
Oregon†	70	— 1	34.6	1.73	
Oswego*[1]	68	3	35.3	3.30	12.0
Ottawa†	73	2	37.8	3.43	9.0
Palestine†	74	10	45.7	5.30	T.
Paris				1.96	
Peoria*a†				2.34	5.0
Peoria*b†	74	6	39.8	2.20	3.0
Philo†	75	2	40.2	3.41	8.0
Plumhill*†[3]	78[g]	15[e]	40.1[e]	4.15[e]	0.5
Rantoul†	75	5	40.8	2.25	7.0
Reynolds	72	0	36.0	0.65	T.
Riley†	67	1	33.8	1.77	6.5
Robinson*†[3]	73	8	42.4	4.92	
Rockford†	73	1	36.4	3.05	10.0
Rose Hill*†[1]	80	10	45.8	6.92	2.0
Roundgrove†	70	1	36.0	0.97	4.0
St. Charles*†[1]	68	4	36.4	3.00	12.0
St. John*†[1]	76	12	44.9	3.86	T.
Scales Mound	69	— 2	32.8	1.07	0.2
Springfield					3.7
Streator†	76	4	38.4	2.07	8.5
Sycamore†	68	1	35.1	1.88	7.5
Tiskilwa*†[3]	69	1	33.7	1.78	6.0
Tuscola†	74	6	42.0	3.18	7.0
Walnut†	72	2	38.0	2.06	6.7
Wheaton*[3]		7	34.9	3.78	8.5
Winnebago†	69	0	34.8	2.18	8.0
Zion†	69	— 1	34.8	0.71	
Indiana.					
Anderson†	71	10	45.0	3.00	T.
Angola*[1]	76	12	40.1	2.12	1.6
Auburn†	71[e]	11[e]	42.3[e]	1.75	
Bloomington†	72	11	45.7	4.36	T.
Bluffton†	73	7	42.2	2.31	T.
Bright†	70	12	47.5	3.67	T.
Butlerville†	71	10	46.9	3.62	
Cambridge City†	70	9	43.6	3.90	
Columbia City*[1]	68	10	40.4	2.50	0.5
Columbus†	74	9	45.3	3.47	T.
Connersville†	69	9	43.9	4.90	T.
Delphi†	72	6	42.6	2.52	2.0
Edwardsville*†[1]	75	11	49.0	4.56	0.1
Evansville†	78	11	47.2	3.10	T.
Farmland†	69	11	43.7	2.30	T.
Franklin*[1]	72	10	44.3	3.76	T.
Greencastle†	70	9	43.0	5.04	0.9
Greensburg				4.13	T.
Hammond†	71	6	38.2	3.27	8.0
Huntington	70	10	40.4	3.05	1.0
Indianapolis					T.
Jasper†	74	13	47.4	1.85	
Jeffersonville	72	15	49.5	5.35	
Knightstown†	70	9	44.1	4.12	T.
Kokomo†	70	9	43.4	2.96	0.2
Lafayette†	72	5	43.7	2.10	1.9
Logansport*†[5]	70	9	39.8	1.19	
Madison†	74	15	48.1	4.27	T.
Marengo†	74	15	48.8	3.76	T.
Marion†	71	9	44.1	2.83	T.
Mauzy†	70	8	43.0	4.30	T.
Mount Vernon†	78	11	49.2	2.85	
Northfield†	70	7	42.8	3.38	T.
Princeton*†[1]	76	12	45.9	3.90	0.8
Richmond	71	11	45.0	3.43	
Rockville†	75	6	43.3	3.58	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Indiana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Scottsburg	73	13	47.8	4.04	
Seymour†	72	14	45.0	3.78	T.
South Bend†	70	9	40.6	2.69	4.5
Sunman	68	8	44.3	3.83	T.
Syracuse†				2.49	6.0
Terre Haute†	75	12	44.2	4.08	T.
Tipton†	72	6	43.2	4.18	
Topeka†	67	10	40.6	1.86	T.
Valparaiso†	74	8	39.7	3.34	5.5
Vevay	76	14	48.9	4.05	T.
Vincennes†	74	11	48.1	4.56	
Warsaw†	71	10	40.4	2.84	T.
Washington†	79	12	48.6	2.18	
Worthington†	74	11	46.0	5.44	T.
Indian Territory.					
Eufaula†				2.70	
Healdton†	85	18	51.6	1.72	
Lehigh†	80	18	51.0	2.56	
South McAlester*[c]	76	11	46.8	2.05	
Tahlequah	81	15	51.2	2.86	0.5
Tulsa†				2.50	
Wagoner	79[f]	13[f]	46.4[f]	2.75	0.5
Iowa.					
Adair				1.26	0.5
Afton	71	— 4	33.2	1.06	
Algona*[1]	55	— 8	23.2	3.25	14.5
Alta*a†	62	— 8	22.2	2.97	8.9
Amana†	70	0	31.6	1.59	T.
Ames*b*	71	— 2	30.4	1.21	2.1
Atlantic†	71	— 4	28.8	1.54	0.5
Atlantic (near)	69[e]	— 7	29.4	0.16	0.5
Audubon	68	— 8	26.9	2.61	2.0
Belknap		0		1.56	0.2
Bellepiaine	69	— 3	29.8	2.64	4.5
Bonaparte†	75	2	35.9	0.72	
Carroll	71	— 2	25.1	1.78	5.0
Cedarfalls†	72	— 4	28.8	2.70	4.0
Cedar Rapids†	72	— 1	31.7	1.61	1.2
Chariton	71	0	31.8	0.78	0.2
Charles City†	67	— 7	25.8	1.62	11.8
Clarinda†	71	— 1	32.9	0.94	T.
Clinton	71	1	35.1	0.72	T.
College Springs	71	— 5	25.2	0.84	
Corning†	71	— 5	31.1	0.80	0.5
Council Bluffs				2.46	T.
Cresco†	63	— 7	24.0	2.53	8.5
Davenport					T.
Decorah†	68	— 7	27.0	2.71	
Delaware*[3]	71	— 3	29.1	1.93	1.2
Denison†	70	— 5	28.5	2.42	2.0
Des Moines					2.6
Dows	69	— 5	30.5	2.19	6.0
Dubuque					T.
Eldora	76	— 5	28.0	3.35	9.0
Elkader†	75	— 6	28.6	2.12	4.2
Estherville	52	— 9	21.6	4.45	14.5
Fairfield†	72	— 1	33.6	0.74	T.
Fayette†	71	— 4	29.4	2.79	2.8
Forest City	58	— 8	21.8	2.58	12.2
Fort Madison*†[1]	72	8	39.6	0.83	
Galva†	67	—11	23.4	2.98	6.3
Gardengrove	72	— 6	31.4	1.62	
Glenwood†	69	— 5	29.2	1.56	T.
Grand Meadow*[1]	64	— 4	27.7	2.73	5.0
Greenfield†	72	— 7	31.0	1.22	1.2
Grinnell†	71	— 2	30.5	1.77	T.
Grundy Center	72	— 5	27.2	1.34	2.5
Hampton	68	— 5	24.6	2.61	7.0
Hopeville†	72	— 4	31.9	1.00	
Humboldt†	65	— 6	25.8	2.15	7.0
Independence†	67	— 5	29.5	1.82	3.0
Indianola†	76	—11	32.8		0.8
Iowa City*a*†	73	— 1	33.8	1.16	0.0
Iowa City*b*	74	2	36.6		
Iowa Falls†	69	— 4	27.2	2.15	7.0
Keokuk					T.
Keosauqua†	73	4	35.4	0.72	0.0
Knoxville	73	— 1	33.1	1.05	T.
Lansing	73	— 4	32.0	3.30	
Larchwood				3.00	10.0
Larrabee†	57	—11	21.8	3.20	9.0
Leclaire†				0.75	0.2
Lemars	67	— 9	28.9	3.20	8.0
Lenox*[1]	70	— 2	32.4	1.01	0.7
Logan†	70	— 5	28.5	2.14	2.0
Madrid	72	— 6	28.0	0.96	3.0
Malvern*[1]	73	— 8	25.9	1.14	T.
Maple Valley				3.12	8.5
Maquoketa*[d]	71	0	31.2	1.06	T.
Marshall†	72	— 3	29.4	1.43	2.8
Mason City†	60	— 8	25.8	2.62	8.5
Mechanicsville	72	— 2	32.1	2.13	0.8
Millman				0.90	1.5
Monticello*†[1]	70	— 2	31.5	1.48	1.0
Mooar	78	4	35.4	0.94	0.0
Mountayr†	71	— 5	32.9	1.39	0.8

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Mount Pleasant*[1]	74	2	37.5	0.89	
Mount Vernon*[1]	72	— 4	32.4	1.40	
Neola	70	— 6	26.2	1.80	
Newton†	73	— 3	30.2	1.12	2.0
North McGregor†				1.30	1.0
Northwood	56	— 8	23.2	4.02	14.0
Ogden	73	— 6	29.5	1.70	3.3
Osage*†[3]		— 9	22.6	3.31	15.0
Osceola	73	— 4	32.7	1.29	0.2
Oskaloosa†	75	2	33.8	1.09	0.9
Ottumwa	74	0	35.0	2.11	1.1
Ovid†	74	— 2	33.7	1.09	0.8
Panama†	68	— 5	28.4	2.55	0.6
Plover				4.19	11.0
Portsmouth	75	— 7	31.0	1.96	T.
Primghar	54	—10[f]	21.4[f]	2.75	4.5
Rock Rapids	52	—15	17.6	3.35	12.0
Sac City†	67	— 6	25.1	2.60	6.0
St. Charles	73	— 4	31.3	0.80	1.5
Scranton	70	— 5	26.8	1.35	0.5
Seymour†	73	— 2	35.2	1.25	0.5
Sibley	52	—10	20.6	4.15	11.2
Sidney	72	— 3	30.8	1.17	0.2
Sigourney	73[e]	— 1[e]	32.9[e]	1.39	0.6
Sioux City					10.1
Spencer	54	— 8	20.8	4.51	9.0
Spirit Lake†	50	— 9	19.2	3.65	9.0
Stuart	69	— 7	31.6	1.67	T.
Toledo	70	— 5	29.0	1.84	3.0
Villisca†	71	— 2	31.2	0.96	T.
Vinton*[1]	72	— 1	30.9	2.01	4.0
Washington†	74	— 1	33.5	0.78	
Waterloo	72	— 3	29.0	1.86	2.0
Waverly	70	— 5	27.6	2.25	6.0
Webster City	65	— 2	27.0	1.73	3.2
Westbend*†[1]	54	— 6	21.9	2.95	11.0
Wilton Junction†	70	— 1	34.4	1.06	T.
Winterset†	70	— 5	31.2	1.19	2.5
Kansas.					
Abilene†	72	3	37.2	1.12	T.
Achilles*[3]	82[e]	—11	25.2	0.15	1.0
Altoona*†[3]	74	9	42.9	1.75	
Anthony				0.70	
Assaria*[5]	68	0	35.0	0.82	T.
Atchison†	76	0	37.0	1.09	T.
Augusta	74	5	41.3	1.33	
Beloit†	71	0	33.8	0.80	T.
Blaine	69	— 4	34.3	1.21	T.
Campbell	71	— 2	34.2	1.49	T.
Colby†	78	—11	32.6	0.25	T.
Columbus†	77	9	43.5	3.14	T.
Concordia					0.2
Coolidge†	71	— 1	35.1	0.58	
Cunningham†	75	0	38.8	1.61	T.
Delphos*[1]	68	0	34.6	1.12	T.
Dodge City					0.1
Downs				0.56	T.
Effingham	77	1	39.2		
Elgin*[1]	76	7	42.4	2.10	
Ellinwood†	76	3	36.9	0.60	
Emporia†	73	7	41.4	1.50	
Englewood†	80	0	38.4	0.34	T.
Eureka†				2.20	
Eureka Ranch†	77	— 6	32.7	0.35	T.
Fall River	76	9	43.0	1.76	
Fort Riley†	73	4	39.0	T.	
Fort Scott†	75	8	43.1	1.67	
Frankfort	78	0	38.0	1.25	
Garfield				0.28	T.
Gibson*[5]	80	— 5	32.4	0.10	T.
Girard*[1]	75	7	42.6	2.00	
Goodland	76	— 8	34.7	0.40	4.0
Gove*†[1]	76	— 4	33.2	0.20	1.0
Grenola*[1]	74	7	40.6	2.25	T.
Halstead	68	0	38.0	1.54	T.
Hutchinson†	76	5	42.8	1.70	T.
Independence†	78	9	43.9	1.35	
Lakin†	80	— 1	41.2	T.	T.
Lawrence	75	4	39.8	1.30	T.
Lebo†	74	5	39.8	1.88	T.
Macksville†	77	3	37.0	0.75	T.
McPherson†	71	4	36.3	1.10	
Manhattan*b*	74	3	38.5	0.91	T.
Manhattan*c*	75	2	40.0	0.71	T.
Marion†	72	3	40.6	0.95	
Meade†				0.40	
Medicine Lodge†	78	5	40.0	1.33	
Minneapolis†	72	3	35.4	0.96	0.1
Morantown†	74	6	41.6	1.35	
Morton†	80	2	40.3	0.24	T.
Mounthope*[1]	73	7	43.6	0.50	
Norwich†	77	7	40.8	0.90	T.
Oberlin†				0.50	1.0
Olathe†	75	1	40.4	1.50	T.
Osage City†	74	2	39.2	1.45	
Oswego†	78	10	43.1	2.33	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ottawa†	77	4	39.7	1.70	T.
Paola†	75	3	41.2	1.55	
Phillipsburg†	72	— 5	32.0	T.	
Powhattan	72	0	35.8	0.90	T.
Pratt	72	0	39.4	0.70	T.
Rome*†	75	9	42.8	1.06	
Russell†	74	— 1	34.6	0.47	0.5
Salina†	73	2	36.6	1.13	T.
Sedan†	76	9	42.9	2.12	
Topeka					T.
Ulysses†	80[d]	0[d]	36.2[d]	T.	T.
Wakefield*†	74	4	39.4	0.72	T.
Wallace*†	74	— 8	33.6	0.07	0.5
Wamego*†	74	2	39.9	0.60	
Wellington*†	75	12	44.6	1.21	
White Rock				1.51	
Wichita					T.
Winfield*†	74	6	41.9	1.85	
Yates Center	75	4	41.1	1.71	T.
Kentucky.					
Alpha†	78	22	54.6	6.82	
Ashland*†	80	22	46.2		T.
Bardstown†	71	17	49.6	5.40	
Blandville†	75	13	48.2	5.55	
Bowling Green *a*†	74	13	48.1	6.43	
Bowling Green *b*†	75	18	51.0	5.42	
Burnside†				5.04	
Caddo†	74	14	47.2	6.98	T.
Canton*†	76	16	50.6	5.12	1.0
Carrollton†	76	14	50.0	3.90	T.
Catlettsburg*†	74	19	48.8	4.27	
Earlington	77	18	51.0	6.56	
Edmonton†	72	16	51.0	5.12	
Eubank*†	76[4]	16[4]	46.0[f]	5.16	
Falmouth†				5.49	
Fords Ferry†	76	14	51.5	4.14	T.
Frankfort†	73	15	48.7	5.24	
Franklin*†	70	16	49.4	6.02	
Georgetown	70	13	48.7		
Greensburg†	76	20	50.8	4.71	T.
Henderson†	80	16	51.6	3.49	0.2
Hopkinsville†	76	15	49.9	6.06	
Leitchfield†	75	13	47.7	5.47	
Lexington *a*†	70	15	48.5	3.88	T.
Lexington *b*					T.
Louisa† *a*				4.07	
Louisville					T.
Lyndon	75	14	49.5	4.17	
Marrowbone†	74	17	49.6	5.63	
Maysville†	76	18	50.3	3.62	
Middlesboro†	75	17	48.2	5.56	
Mount Sterling†	71	14	47.2	3.07	T.
Munfordville†	75	20	49.7		
Owensboro†	77	15	49.8	4.83	
Owenton†	71	13	46.6	6.10	T.
Paducah *a*†				5.35	0.5
Paducah *b*†	78	14	50.2	5.27	
Pleasure Ridge Park†	74	13	48.3	4.93	0.1
Princeton†	78	15	48.4	4.98	0.5
Richmond†	78	11	51.0	3.08	T.
Russellville†	80	15	51.4	6.84	
St. John†	74	14	49.1	4.68	T.
Sandyhook				3.97	
Shelbyville†	73	14	48.7	5.23	
Southfork†[3]			46.0	4.42	
Vanceburg†				3.15	
Williamsburg†	77	23	51.2	4.80	1.0
Louisiana.					
Abbeville	83	32	64.1	4.91	
Alexandria†	87	26	61.0	5.68	
Amite†	89	27	62.8	6.89	
Bastrop†	89	26	61.4	5.13	
Baton Rouge†	86	30	64.5	4.26	
Cameron†	83	32	62.8	3.70	
Cheneyville†	88	25	59.2	6.52	
Clinton†	84	28	60.7	4.12	
Covington†	92	24	68.5	6.53	
Davis	86	24	57.2	5.16	
Donaldsonville†	88	34	65.6	7.48	
Elm Hall	79	28	60.1	8.36	
Emilie†	81	32	62.3	5 60	
Farmerville	86	26	55.8	5.92	
Franklin†	84	32	64.2	8.42	
Grand Coteau	83	34	63.4	3.78	
Hammond†		28		5.17	
Houma†	85	30	66.0	5.63	
Lafayette†	85	30	62.2	6.30	
Lake Charles†	89	26	66.2	5.00	
Lake Providence	76	24	56.0	3.43	
Lawrence†	85	35	63.2	4.37	
Liberty Hill	90	25	59.0	6.73	
Mansfield†	87	25	57.9	3.80	
Maurepas*	90	29	62.4	7.13	
Minden†	85	30	54.1	4.49	
Monroe†	80	25	58.6	5.44	
Montgomery	86	28	59.8		

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Louisiana—Cont'd.	°	°	°	*Ins.*	*Ins.*
New Iberia	84	32	64.0	5.80	
Oakridge†	84	26	57.3	6.69	
Oberlin	85	30	63.3	5.10	
Opelousas†	89	29	63.9	4.21	
Oxford†	87	27	59.5	5.49	
Palmcourtville†	85	31	63.8	9.03	
Plain Dealing†	84	27	57.2	1.90	
Rayne†	88	32	65.5	7.61	
Robeline†	86	25	57.6	5.36	
Ruston	84	28	58.8	7.12	
Schriever†	91	29	61.8	8.33	
Shellbeach†	79	33	05.4	5.46	
Southern University†	88	35	64.0	4.95	
Sugar Ex. Station†	85	34	63.4	4.71	
Sugartown†	84	34	62.1	7.36	
Thibodeaux				9.78	
Venice†	84	42	67.4	2.13	
Wallace	84	33	60.9	5.29	
West End				3.70	
White Sulphur Springs†	88	28	63.7	6.85	
Maine.					
Bar Harbor	65	13	39.6	5.10	4.0
Belfast*[6]	58	10	37.0	4.25	5.0
Calais†	63	1	37.4	4.16	7.0
Cornish*†	66	7	38.4	4.19	6.0
Cumberland Mills	73	2	39.0	2.68	
Eastport					4.7
Fairfield	62	— 6	36.5	2.35	5.0
Farmington†	67	0	36.4	4.22	7.2
Flagstaff†	64	—10	33.2	2.80	5.5
Fort Fairfield†	55	—11	32.2	4.60	13.5
Gardiner	67	3	38.4	4.12	7.8
Kineo†	56	5	32.7	1.95	4.0
Lewiston	64	9	38.2	3.79	8.5
Mayfield	57	— 1	31.6	5.11	8.5
North Berwick[f]	72	5	39.6		
North Bridgton	68	8	39.0	5.08	8.5
Petit Menan*†	52	17	41.0		
Portland					4.4
Winslow	64	— 6	36.9	2.89	5.5
Maryland.					
Bachmans Valley	72	23	47.1	3.70	2.5
Baltimore					3.0
Boettcherville*†	72	24	44.0	4.30	T.
Charlotte Hall†	77	29	54.0	1.08	0.5
Cherryfields†[2]			51.2	2.28	3.0
Chestertown†	71	28	50.0	1.77	1.0
Collegepark	77[1]	21[1]	47.2[2]	2.50	1.5
Cumberland *a*	74	27	46.3	3.68	
Cumberland *b*	74	29	50.5	3.63	T.
Darlington†	72	26	49.5	4.49	6.0
Deerpark	69	13	43.1	3.33	
Easton†	74	28	51.0	1.90	0.5
Ellicott City	75	28	52.1	3.13	5.0
Fallston*†	72	24	48.5	5.60	5.0
Flintstone	72	19	46.3	4.05	
Frederick *a*	74	25	49.4	3.12	2.0
Grantsville	72	18	43.8	3.37	3.5
Greatfalls*[5]	73	25	50.3	2.53	
Greenspring Furnace	74	22	48.0	2.85	0.5
Hagerstown†	74	27	49.4	2.54	
Jewell†	76	27	52.6	2.11	0.5
Johns Hopkins Hospital	75	29	49.6		
Laurel	77	24	50.0	2.60	3.0
McDonogh	73	26	51.2		
Mardela Springs†	75	28	51.9	1.89	1.8
Mount St. Marys Coll.†	74	25	48.4	4.63	T.
New Market	74	24	49.2	3.43	4.0
Princess Anne	75	21	49.8	2.01	1.0
Sharpsburg	74	27	48.8	2.51	1.5
Solomons†	75	29	53.4	2.10	2.0
Sunnyside	70	12	42.0	5.29	2.8
Taneytown†	76	27	49.4	3.20	2.0
Van Bibber	69	19	47.2	4.57	
Western Port	78	19	45.5	2.83	0.5
Westminster	73	28	52.6		
Woodstock	76	21	47.7	3.40	2.5
Massachusetts.					
Adams	66	18	42.4		
Amherst	70	17	43.5	2.87	1.0
Andover†				2.58	6.0
Ashland				3.12	
Attleboro				3.57	
Bedford	70	16	43.0	3.18	3.0
Bluehill (summit)	69	18	44.5	3.82	6.0
Bluehill (valley)	72	16	43.6	3.96	
Boston (W. B.)					2.2
Brockton *a*	73	20	45.5	4.09	3.5
Brockton *b*				3.92	
Brockton *c*				4.47	
Cambridge *a*	72	19	45.5	3.34	
Chestnut Hill	71	20	45.2	3.61	4.5
Clinton *a*				1.88	
Clinton *b*	77	18	46.8		
Cohasset				6.05	1.0
Concord†	72	14	42.2	2.59	2.9

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Massachusetts—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dudley[1]	68*	16	43.7	1.60	
East Templeton*†	65	16	40.2	2.26	2.0
Egg Rock, Nahant	66	22	44.2		
Fallriver	69	21	41.8	3.38	6.0
Fiskdale				2.34	3.0
Fitchburg *a*†	66	14	41.3	3.00	1.0
Fitchburg *b*	68	14	42.5	3.11	1.5
Framingham	70	18	44.2	2.92	
Groton	69	11	40.9	2.72	3.0
Hadley	70	12	41.4	3.03	1.5
Hingham				4.61	6.0
Hobbs Brook				2.83	1.8
Hyannis*†	64	28	49.7	3.87	0.2
Hydepark*[6]		18	43.8		3.0
Lake Cochituate	74	13	44.0	3.00	
Lawrence	71	16	42.5	2.81	2.5
Leeds	68	14	41.9	3.87	T.
Leicester Hill	67	13	41.4	2.12	1.0
Leominster				2.95	1.2
Long Plain*[6]	67	22	45.5	3.67	3.0
Lowell *a*	68	16	42.8	3.02	
Lowell *b*	71	15	43.1		
Lowell *c*	74	17	44.6		
Ludlow Center	70	14	39.5	2.35	1.5
Mansfield*†	70	17	43.3	4.00	5.0
Middleboro	69	19	44.8	3.50	4.2
Milton	67	19	45.0	3.49	2.0
Monroe	60	11	38.2	4.73	1.5
Monson	71	16	44.1	2.38	2.5
Mount Nonotuck				2.85	1.5
Mount Wachusett				2.87	1.2
Mystic Lake				3.56	
Mystic Station				3.62	
Nantucket					0.4
Natick*†	67	16	43.0	3.39	3.5
New Bedford *a*	67	22	45.8	2.60	4.0
New Bedford *b*	68	19	46.8	2.93	3.0
North Billerica	70	17	43.1	3.68	6.0
Pittsfield	63	12	41.4	2.62	2.0
Plymouth*†	67	24	45.3*	3.41	5.0
Princeton				2.83	1.5
Quinapoxet	64	10	43.0	3.34	1.1
Roberts Dam				3.37	3.0
Roxbury	70	23	45.5	3.74	3.0
Salem				3.98	6.0
Somerset*†	70	22	49.1	3.21	6.0
South Clinton				2.98	1.0
Springfield Armory	71	15	42.6	2.90	1.5
Sterling				2.91	1.5
Taunton *b*	69	19	45.0	3.70	5.0
Taunton *c*	70	17	45.0	3 87	
Turners Falls	63	16	41.2	3.50	1.0
Vineyard Haven					T.
Wakefield†	71	17	44.6	3.59	2.0
Waltham				3.41	
Webster				2.98	1.0
Westboro†	70	15	46.4	2.77	2.0
Weston	70	17	43.0	2.91	4.8
Williamstown*†	64	19	42.2	2.98	1.5
Winchendon				2.35	1.0
Winchester				3.08	
Woods Hole					0.6
Worcester *a*	68	20	44.3	2.46	
Worcester *b*	68	20	44.8	3.02	1.0
Michigan.					
Adrian	69	14	40.2	1.61	0.5
Allegan	71	14	42.0	4.10	7.5
Alma	66	10	36.4	4.05	5.0
Alpena					1.1
Ann Arbor	67	10	38.6	1.82	T.
Arbela	65	10	36.8	2.83	4.0
Baldwin	63	8	35.8	2.92	3.0
Ball Mountain	64	14	38.0	2.30	0.9
Baraga	55	— 6	26.2	5.13	16.0
Battlecreek	68	13	38.4	2.64	4.3
Bay City *b*	66	9	37.2	3.12	2.0
Benton Harbor	69	18	40.8	3.25	T.
Benzonia	70	8	36.8	5.05	8.1
Berlin*†	68	10	38.6	1.82	1.2
Berrien Springs	70	14	39.8	5.87	17.0
Big Rapids	62	11	34.4	4.17	0.2
Birmingham	66	10	39.1	2.14	T.
Boon	60[d]	6	30.4[e]	4.94	3.2
Bronson	66	12	38.7	1.61	T.
Calumet	47	0	25.9	5.66	41.0
Carsonville	65	11	37.8	2.16	2.0
Charlevoix	58	12	35.0	4.15	14.0
Cheboygan	60	10	33.0	4.01	4.5
Clinton	68	14	40.0	1.93	T.
Detroit					T.
Escanaba†	52	— 2	29.2	3.41	13.0
Fairview	66	12	39.9	1.40	T.
Fitchburg	64	13	36.4	2.41	2.0
Flint	67	11	37.2	2.14	6.8
Gaylord	59	7	31.4	6.80	19.5
Gladwin	64	9	34.8	5.57	2.5

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Grand Haven	.....	.....	.....	.....	7.0
Grand Rapids*b*	68	13	38.4	3.96	8.0
Grape	72	12	42.0	1.49	0.5
Grayling	62	5	35.0	2.80	6.0
Hanover	66	14	40.4	2.42	3.0
Harrison	62	4	32.7	3.07	2.9
Harrisville	64	2	35.4	3.60	0.9
Hart	63	11	36.6	4.15	1.9
Hastings	66	15	38.2	2.71	3.1
Hayes	65	12	39.4	2.28	.....
Hesperia	60	10	35.9	2.64	8.0
Highland Station	66*	13*	35.9*	2.57	1.5
Howell	67	14	38.2	2.00	0.1
Ionia	68	13	38.2	2.50	4.0
Iron River	57	—12	23.9	4.45	18.5
Ivan	68	8	38.6	4.84	8.5
Jeddo	65	10	37.2	1.74	4.5
Kalamazoo	67	10	38.7	3.55	8.2
Lansing	67	7	37.4	2.98	2.8
Lewiston	60	— 1	32.7	4.81	4.2
Ludington *[p]	60	10	35.8	.....	.....
Luzerne	62	1	31.9	4.04	6.0
Mackinaw City	63	11	33.4	6.90	4.0
Madison	67	13	39.9	1.91	0.8
Mancelona	61	8	32.6	6.76	27.1
Manistee	63	8	35.8	.....	.....
Manistique	50	— 4	29.9	4.58	8.5
Marquette	.....	.....	.....	.....	31.0
Mayville	65	10	36.9	2.66	5.2
Midland	65	4	36.1	2.95	T.
Mottville	70	9	40.3	2.45	0.9
Mount Clemens	64	15	37.6	1.44	T.
Mount Pleasant*b*	65	9	35.9	2.54	1.8
Muskegon	62	13	36.8	3.37	2.5
Newberry	55	1	29.1	6.69	13.5
North Marshall	70	14	37.0	2.93	3.0
Northport	64	9	35.8	2.19	9.0
Old Mission	63	9	34.6	5.51	7.0
Olivet	65	12	37.6	2.81	0.3
Ovid	64	13	37.4	3.24	5.0
Owosso	66	12	38.5	3.11	6.2
Parkville	.....	.....	.....	3.28	5.0
Petoskey	62	11	33.9	5.58	8.0
Plymouth	68	14	39.4	1.39	T.
Pontiac	65	16	38.2	1.65	0.5
Port Austin	64	10	36.9	1.68	2.0
Port Huron	.....	.....	.....	.....	1.2
Powers	57	— 5	28.9	5.19	14.0
Reed City	61	9	34.1	3.75	4.3
Rockland	55[d]	—11[d]	24.5[d]	6.40	33.0
Rogers City	64	9	34.7	4.64	4.2
Romeo	66	13	41.4	1.42	T.
Saginaw	66*	10*	38.2*	2.19	3.5
St. Ignace	59	10	33.6	5.40	8.5
St. Johns	66	15	38.6	2.80	4.7
Sandbeach*a*	.....	.....	.....	1.80	.....
Sault Ste. Marie	.....	.....	.....	.....	17.5
Somerset	66	10	39.2	2.11	1.5
South Haven	68*	16	40.9	2.56	0.7
Stanton	65	12	38.7	1.97	T.
Thornville	66	12	39.2	1.86	6.0
Vandalia	70	18	41.2	3.73	4.4
Waverly	66	10	37.0	3.75	5.3
Wetmore	55	— 6	27.1	6.67	31.0
Ypsilanti	66	16	41.4	1.94	1.0
Minnesota.					
Adat	38	—35	10.6	1.90	22.0
Albert Lea†	55	— 9	24.2	4.37	16.7
Alexandria†	42	—20	14.8	1.75	10.0
Beardsley†	42	—20	14.1	2.10	15.6
Bellepiaine*[1]	47	—10	19.2	0.61	6.1
Bird Island	46	—13	17.6	2.09	5.0
Blooming Prairie†	55	—10	21.6	3.75	12.5
Bonniwell†	45[d]	—13	22.0[d]	1.51	.....
Caledonia†	65	— 6	26.4	3.13	8.0
Cambridge†	46	—15	19.7	3.92	9.5
Camden	56	—11	19.4	2.35	5.0
Collegeville	48	—13	19.3	1.79	12.8
Crookston†	36	—30	10.4	.....	10.5
Dawson *[1]	46	—14	17.6	1.19	6.5
Duluth	.....	.....	.....	.....	19.5
Farmington†	50	—14	19.0	5.18	13.5
Fergus Falls†	37	—28	14.7	2.08	17.3
Glencoe†	64	—10	22.8	3.21	.....
Glenwood†	40	—17	15.6	2.33	7.6
Grand Meadow†	58	—10	21.8	3.08	13.8
Lakeside†	46	—12	16.6	2.10	6.5
Lake Winnibigoshish *[1]	33	—29	14.9	2.49	16.6
Lambert†	37	—33	10.4	2.65	26.5
Lawrence†	.....	.....	.....	0.39	3.5
Lesueur*†	52	—12	21.4	4.10	11.0
Long Prairie†	46	—19	17.1	1.76	6.7
Luverne†	45	—10	16.4	.....	9.5
Maplepiain	48	—13	19.7	4.19	13.5
Maplewood*†	49	—10	22.1	.....	.....
Mazeppa[1]	50*	—10	28.1	3.00	14.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Minnesota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Milan†	44	—19	15.3	2.05	13.3
Minneapolis*a*†	50	—11	21.2	4.17	9.9
Minneapolis*b*[1]	50*	—11	20.4	4.05	9.4
Minneapolis (W. B.)	.....	.....	.....	.....	8.8
Minnesota City *†[1]	64	— 6	27.5	2.68	12.0
Montevideo†	45	—15	17.2	1.89	6.0
Moorhead	.....	.....	.....	.....	30.4
Morris	42	—18	15.8	1.34	6.1
New London	48	—18	19.8	1.78	6.0
New Richland *[1]*	46	—10	21.8	.....	.....
New Ulm†	48	—10	20.8	3.99	6.5
Park Rapids†	40	—32	12.4	2.65	21.0
Pine River *[1]	40	—25	15.5	2.49	12.8
Pleasant Mounds†[1]	49	— 8	21.3	4.26	10.5
Pokegama Falls[1]	35*	—45	11.5	2.69	15.5
Reeds†	.....	.....	.....	3.68	13.0
Rolling Green	49	— 7	20.0	3.60	15.0
Roseau	40[d]	—36[d]	6.2[d]	2.40	24.8
St. Charles†	58	— 8	24.4	3.21	13.0
St. Olaf	40	—21	14.7	1.88	15.0
St. Paul	.....	.....	.....	.....	14.0
St. Peter	42	—23	24.2	.....	.....
Sandy Lake Dam[1]	42*	—32	15.8	2.39	23.5
Sauk Center *[1]	43	—23	13.2	1.27	5.3
Shakopee[6]	48*	—12	21.8	4.43	9.5
Tower†	40	—39	13.1	2.00	17.0
Two Harbors†	53	—18	24.0	3.96	13.5
Wabasha*[1]	57	— 7	24.3	3.58	15.4
Willmar†	44	—15	16.6	2.96	2.7
Winona	61	— 3	26.2	3.08	12.0
Worthington	51	—11	19.2	5.47	6.8
Zumbrota[1]	52*	—12	22.5	.....	.....
Mississippi.					
Agricultural College	79	22	56.9	4.38	T.
Austin†	78	21	54.6	8.13	
Batesville†	76	21	54.0	6.85	
Bay St. Louis	81	34	65.8	2.54	
Biloxi†	79	31	62.7	2.98	
Briers†	84	27	58.7	4.95	
Brookhaven†	87	25	60.6	5.35	
Canton†	84	25	60.0	4.80	
Columbus*a*†	.....	.....	.....	6.18	
Columbus*b*	84	23	57.9	.....	
Crystal Springs†	85	25	59.2	3.72	
Edwards	86	26	59.8	2.79	
Fayette†	83	27	62.1	3.20	
French Camps†	85	17	54.6	3.34	
Fulton†	80	22	55.2	4.08	
Greenville*a*	77	24	56.4	5.63	
Greenville*b*†	84	24	57.9	4.73	
Hazlehurst†	88	26	60.8	2.91	
Itta Bena*	86	23	52.8	2.90	
Jackson†	86	21	57.3	4.08	
Kosciusko†	85	20	56.6	4.45	
Leakesville†	87	29	63.2	4.95	
Logtown†	81	30	64.0	2.20	
Louisville†	86	22	57.8	4.57	
Macon†	86	24	56.3	1.70	
Magnolia†	88	29	61.5	5.99	
Mayersville	86	24	59.0	4.43	
Meridian†	82	21	58.9	3.66	
Mosspoint	86	34	65.0	1.38	
Natchez†	88	28	61.4	2.75	
Okolona†	81	21	53.2	.....	
Palo Alto†	83	23	56.6	3.76	
Poplarville	.....	.....	.....	3.61	
Port Gibson†	87	26	60.9	5.13	
Rosedale†	80	23	54.6	6.57	
Stonington *[1]	86	26	60.6	.....	
Thornton†	84	26	58.8	2.90	
Topton*[5]	84	28	61.0	3.40	
Water Valley *†[1]	77	20	53.9	3.65	
Waynesboro*a*	86	28	57.4	2.35	
Waynesboro*b*†	85	30	61.4	4.55	
Woodville†	85	29	61.4	4.27	
Yazoo City†	88	25	58.2	2.56	
Missouri.					
Akron	.....	.....	.....	1.07	T.
Appleton City	78	7	42.6	2.50	T.
Arthur*†[3]	.....	9	40.5	2.44	
Avalon	75	0	38.1	1.76	T.
Bethany	74	0	38.2	1.29	0.5
Birchtree	79	9	45.7	4.91	
Bolckow†	.....	.....	.....	0.75	T.
Boonville†	.....	.....	.....	2.78	T.
Brunswick	75	4	40.6	1.48	
Carrollton†	74	6	41.6	1.98	
Cedargap *[1]	80	8	44.1	1.88	T.
Columbia	.....	.....	.....	.....	T.
Conception	69	3	37.0	0.94	T.
Cowgill *[5]	76	— 2	38.2	1.62	T.
Darksville†	74	4	41.0	0.92	
Downing	.....	.....	.....	1.02	0.1
East Lynne *[3]	.....	5	39.2	1.59	
Edgehill *[5]	74	12	43.4	3.91	
Eightmile *[1]	74	5	40.6	1.72	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*I*	*Ins.*
Eldon *[1]	80	14	47.2	2.62	
Elmira	78	9	38.9	1.64	T.
Emma *[3]	.....	4	38.9	1.77	
Farmersville	.....	.....	.....	1.78	T.
Fayette	76	5	40.6	1.48	T.
Fulton	.....	.....	.....	2.40	
Gallatin *[1]	75	1	37.6	1.56	T.
Gayoso *[3]	.....	14	46.8	6.80	1.0
Glasgow	76	4	41.0	1.32	.....
Gordonville *[3]	.....	14	44.7	3.87	0.2
Gorin *[3]	76	8	37.4	1.12	
Grovedale	80	6	44.4	1.98	1.0
Halfway	76	9	44.8	1.56	T.
Hannibal	.....	.....	.....	.....	0.1
Harrisonville†	75	5	40.8	1.75	T.
Hermann†	.....	.....	.....	1.98	T.
Houston	78	6	48.1	2.17	
Houstonia	.....	.....	.....	1.79	T.
Humansville	79	8	45.1	3.18	T.
Irena	.....	.....	.....	1.19	0.5
Ironton†	80	9	44.7	4.38	T.
Jefferson City†	79	10	44.4	2.10	
Kansas City	.....	.....	.....	.....	T.
Kidder	76	0	37.0	1.53	0.2
Lamar†	76	10	43.7	3.96	
Lamonte	.....	.....	.....	2.39	T.
Lebanon	80	8	46.3	1.92	
Lexington†	76	4	42.2	1.84	
Liberty	75	5	39.7	1.52	0.1
McCune *†[1]	75	5	42.2	1.83	1.5
Macomb	.....	.....	.....	2.20	0.5
Mansfield	.....	.....	.....	1.25	0.5
Marblehill	78	11	46.2	2.96	T.
Marshall†	78	4	40.1	1.75	T.
Maryville	73	— 5	33.8	0.83	T.
Mexico†	77	6	42.3	1.65	0.1
Mine La Motte†	78	12	46.7	4.00	0.2
Mineralspring	79	9	49.8	2.63	1.0
Montreal *[1]	75	9	42.6	2.20	T.
Mount Vernon	82	6	43.6	1.62	T.
Neosho	77	10	47.4	3.70	T.
Nevada	.....	.....	.....	1.62	
New Haven *[1]	76	7	44.9	1.20	
New Madrid	73	12	52.0	5.86	0.5
New Palestine *†[1]	77	8	41.7	1.78	T.
Oakfield	76	10	45.5	3.23	2.0
Oakmound	.....	.....	.....	3.20	
Oakridge *[1]	.....	13	47.4	3.66	0.8
Olden†	77	9	46.2	4.24	T.
Oregon *a*	75	0	37.4	0.74	T.
Oregon *b* [1]	72	— 1	35.0	0.70	T.
Osceola†	.....	.....	.....	2.75	T.
Oto	.....	.....	.....	2.00	T.
Palmyra *[5]	80	6	41.0	1.78	
Phillipsburg *†[1]	78	7	43.0	1.95	T.
Pickering *[3]	74	0	36.6	1.49	0.5
Platte River *[3]	72	0	35.5	1.21	T.
Poplar Bluff	79	13	49.2	3.11	
Potosi	76	0	40.3	3.84	1.0
Princeton *[1]	75	— 1	36.8	1.66	T.
Rhineland	76	10	45.0	1.56	
Richmond	73	4	39.1	2.05	
Rolla	.....	.....	.....	1.89	0.6
St. Charles	80	8	45.6	2.86	3.0
St. Joseph†	.....	.....	.....	0.88	T.
St. Louis (V. O.)	78	10	44.6	3.69	1.5
St. Louis (W. B.)	.....	.....	.....	.....	0.7
Sarcoxie *[3]	78	8	42.7	2.60	
Shelbina	.....	.....	.....	1.30	
Sikeston	79	16	51.0	1.70	0.5
Springfield	.....	.....	.....	.....	0.2
Steffenville	.....	.....	.....	1.47	T.
Stellada†	78	5	42.8	2.48	
Sublett	75	2	37.4	1.46	
Trenton	78	0	37.4	2.20	
Unionville†	76	— 1	36.0	1.38	0.5
Virgil City	.....	.....	.....	3.63	T.
Warrenton	77	7	42.5	1.58	T.
Wheatland	.....	.....	.....	4.14	T.
Willow Springs	78	9	47.5	2.39	
Zeitonia *[1]	79	12	44.2	4.48	T.
Montana.					
Augusta†	58	—27	13.7	1.30	12.8
Bigtimber†	67	—15	24.0	1.90	19.6
Billings†	70	—20	18.4	1.99	15.9
Boulder	60	—32	20.0	.....	.....
Bozeman†	60[1]	—26*	23.8[8]	1.70	17.0
Butte†	55	—24	21.7	1.62	16.0
Chinook†	56	—30	6.7	0.90	9.0
Choteau†	64	—30	9.2	1.20	12.0
Cokedale†[4]	56	—18	21.9	3.51	34.0
Deer Lodge	68	—30	26.9	.....	.....
Fort Custer†	71	—26	18.5	1.71	14.7
Fort Keogh†	61	—33	11.4	1.72	17.2
Fort Logan†	61	—42	19.2	2.71	.....
Fort Missoula	60	—10	28.0	1.92	8.0

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Montana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Glasgow†	44	−41	4.3	1.75	17.5
Glendive†	42	−26	12.0	2.00	20.0
Greatfalls†	61	−22	14.6	1.54	15.4
Havre					15.5
Helena					31.7
Hogan†	56	−25	14.6	2.54	18.0
Kipp†	49	−39	4.6	3.65	36.5
Lewistown†	66[b]	−15[b]	19.0[b]	2.43	24.0
Libby†	62	−27	25.5	8.61	56.3
Livingston†	60	−13	23.0	1.56	15.6
Manhattan†	64	−37	21.1	1.45	12.0
Martinsdale†	65	−28	20.4	2.10	21.0
Marysville†	52	−21	16.9	3.47	24.3
Miles City					13.7
Poplar†	44	−36	7.8	1.65	16.5
St. Ignatius Mission†	60	−11	31.7	1.74	
St. Pauls†	50	−22	11.0	1.55	15.1
Troy	58	−19	26.0	7.06	
Utica†	58	−26	14.4	4.67	46.7
Virginia City†	58	−23	22.4	1.84	18.4
Wibaux†		−27		2.15	21.5
Yale†		−23		1.99	19.2
Nebraska.					
Agee*[1]	70	−10	19.1	2.00	20.0
Albion†		−12		1.10	11.0
Alliance*[1]	68	−18	24.1	0.39	3.5
Ansley†	79	−13	26.2	0.80	3.0
Arborville*[1]	78	− 4	30.5	2.35	1.0
Ashland *a*†	72	− 2	31.1	1.88	0.5
Ashland *b**[1]	70	− 5	30.1	1.85	0.2
Ashton	79	−11	23.4	1.12	1.0
Auburn*†	74	− 4	33.8	1.26	T.
Aurora*[1]	78	− 5	28.3	1.70	
Bassett	61	−18	16.8	1.35	12.0
Beatrice†	68	− 1	33.7	1.26	T.
Beaver City†	85	−10	32.0	0.33	2.0
Bratton	75[c]	− 1	30.2[c]	1.05	T.
Brokenbow*[1]	75	−11	24.8	0.30	3.0
Burchard				1.85	
Burwell*[1]	58	−12	21.2	0.70	7.0
Callaway†	75	−12	25.0	0.20	3.0
Central City*[5]	58	− 2	28.6	2.10	1.0
Chester*[1]	70	− 1	29.9	1.75	T.
Columbus†	76	− 4	28.2	2.23	0.5
Cornlea				2.38	T.
Creighton†	69	−15	19.6	2.57	18.0
Crete	70	− 1	30.9	1.58	1.5
Culbertson				0.10	
Curtis *b*†				0.05	0.5
David City*†[1]	70	− 4	27.0	2.60	1.0
Divide				0.65	
Dunning				0.76	7.0
Edgar*[1]	76	− 4	28.5	2.00	
Ericson*†[1]	74	−12	21.8	0.60	6.0
Ewing†				0.90	9.0
Fairbury†	67	− 1	31.9	1.14	T.
Fairmont†	74	2	29.0	1.67	T.
Fort Robinson	61	−11	25.3	0.80	8.0
Franklin†	81	1	31.6	0.70	0.5
Fremont†	72	− 4	27.6	1.04	
Geneva†	73	− 3	29.8	1.98	0.5
Gering†	71	−21	25.8	0.48	2.5
Gibbon				2.30	
Gothenburg	74	−11	27.2	1.05	
Grand Island *a*[1]	86	− 4	30.8	1.31	
Greeley	84	−13	22.6	0.45	4.5
Haigler*[1]	68	− 8	27.8	0.02	0.2
Hartington†	67	−13	20.7	3.85	17.0
Harvard*[1]	74	− 5	27.4	1.49	T.
Hastings*[1]	73	− 5	28.6	1.36	1.0
Hay Springs†				1.37	13.3
Hebron†	73	− 2	31.5	1.67	T.
Hickman				1.10	
Imperial *a*†	78	−18	27.2	0.20	2.0
Kearney*[1]	70	0	30.6	1.55	1.0
Kimball†	72	−18	30.2	0.30	3.0
Kirkwood*[1]	57	−10	18.0	1.50	15.0
Lexington†	80	−11	28.4	0.28	0.5
Lincoln *b*†	70	0	30.8	0.79	1.0
Lincoln *c*	72	− 1	30.8	1.48	2.0
Lincoln *d*	69	− 2	32.4	1.34	2.0
Lodgepole†	75	−22	26.6	0.50	5.0
Loup *a**[1]	80	−10	29.1		
Loup *b**[1]	78	− 8	26.8	0.64	2.0
Lynch*†[1]	56	−12	19.2	1.47	14.0
McCook*[1]	57	− 8	29.8		
McCool				0.91	
Madison*[1]	80	− 9	23.6	2.35	3.5
Marquette				1.65	0.8
Milford				2.45	0.5
Minden *a*[1]	75	−10	27.9	1.77	9.5
Minden *b*				1.64	
Nebraska City *a*†	74	− 4[c]	30.9[c]	0.92	T.
Nebraska City *b*[1]	72	1	32.0	0.87	
Nemaha*[1]	68	− 2	31.9	0.70	T.
Nesbit†	74	−10	28.2	0.20	2.0
Nebraska—Cont'd.					
Norfolk†	68	−10	23.4	2.54	3.8
Norman	75	−10	30.8	1.27	0.5
North Loup†	75	−11	25.5	1.12	
North Platte					1.1
Oakdale†	72	−15	20.8	2.66	10.3
Odell*[5]	70	0	33.7	1.33	T.
Omaha					0.1
O'Neill†	69	−12	19.0	1.37	14.2
Osceola				2.55	2.5
Ough†				T.	T.
Palmer *a**[1]	74	−10	27.1		
Palmer *b*				1.22	3.5
Plattsmouth *a*†				1.72	0.5
Ravenna *a*	82	−10	27.8	1.30	2.7
Republican*[1]	80	− 6	31.0	1.45	
Rulo				0.32	0
St. Libory	72	− 9	27.6	2.00	2.5
St. Paul	77	− 6	29.5	2.04	4.0
Salem				0.48	T.
Santee Agency†	63	−13	19.4	2.00	14.0
Sargent				1.29	4.0
Schuyler				3.05	1.0
Seneca*[1]	72	−14	22.7	0.50	5.0
Seward*[5]	75	0	30.7	1.29	0.2
Springview	46	−13	18.8	0.92	13.5
Stanton*[1]	73	− 8	23.6	2.79	7.1
Strang*[1]	69	− 3	30.7	1.85	
Stratton				0.08	
Stromsburg				1.91	
Superior*[5]	70	− 4	31.1	1.43	T.
Sutton	76	− 3	29.4	2.13	1.0
Syracuse				1.24	T.
Tecumseh *b*†		1		1.25	T.
Tekamah	73	− 8	28.6	2.40	5.5
Thedford*[1]	78	−20	21.7	1.15	9.5
Turlington†	67	− 7	27.7	1.57	T.
Valentine†	55	−18	18.5	2.57	
Wakefield				3.17	9.5
Wilber*[1]	68	4	33.1	1.55	T.
Wilsonville*[1]	80	−13	32.1	0.27	0.5
Wisner				3.00	6.5
Woodlawn				1.04	
York*[1]	72	− 2	29.5	1.40	
Nevada.					
Austin	61	0	36.5	0.41	3.5
Battle Mountain*[1]	70	− 6	35.2	0.85	0.5
Beowawe*[1]	63	−15	31.9	0.90	4.5
Candelaria	72	8	43.2	T.	T.
Carlin*[1]	67	−16	32.0	0.17	1.5
Carson City	71	7	40.4	1.53	0.4
Carson City (W. B.)					0.5
Cloverdale*[1]	64	13	39.0	0.25	2.5
Cranes Ranch				0.89	6.0
Darrough Ranch				0.11	
Downeyville	79	5	44.0	0.20	T.
Duckwater	63	10	32.4	0.30	
Elko*[5]	68	− 7	34.4	1.60	3.0
Elko (near)	68	−16	34.8	1.40	1.0
Ely	62	−16	31.0	1.10	0.2
Fenelon*[1]	51	−18	27.2	1.44	6.0
Golconda*[1]	68	−10	39.4	0.62	
Halleck*[1]	50	−18	25.2	0.89	3.5
Hawthorne *a*[5]	65	20	43.3	0.75	6.
Hawthorne *b*	68	16	43.0	0.40	6.5
Hot Springs*[1]	68	0	36.4	0.32	4.0
Humboldt*[1]	64	− 4	40.2	1.02	1.0
Knickerbocker Mills	64	5	38.8	0.56	6.[illegible]
Lewers Ranch	69	4	41.1	3.70	0.7
Los Vegas	68	19	45.4	0.24	
Lovelock*[1]	62	8	39.4	0.14	
Mill City*[1]	68	− 5	36.8	0.70	
Osceola	71	− 6	37.4	0.34	0.5
Palisade*[1]	60	− 5	36.0	1.30	5.0
Palmetto	68	− 6	37.6	0.35	
Reese River				0.30	3.0
Reno*[5]	68	14	42.9		
Reno State University	69	7	38.8	0.89	0.7
Ruby Valley				2.52	12.6
St. Clair	70	2	38.6	0.37	
San Antonio	61	5	36.2	0.30	T.
Sodaville	73	9	42.4	0.12	
Stofiel	58	− 7	27.7	4.29	19.0
Tecoma*[1]	51	− 6	29.7	0.40	1.0
Toano*[1]	58	−14	30.6	1.75	10.0
Tuscarora	53	−13	30.0	3.22	4.2
Tybo	58	− 3	34.8	0.12	2.0
Verdi*[1]	65	8	41.2	2.05	T.
Wadsworth*[1]	78	− 2	36.8	0.44	T.
Wells	56	−23	30.1	1.13	3.3
Winnemucca					3.0
New Hampshire.					
Alstead*[6]	66	9	39.4	2.78	1.5
Berlin Mills	65	− 9	31.8	2.09	5.0
Bethlehem	65	4	35.6	2.68	9.0
Brookline*[1]	72	12	42.7	3.11	1.0
Concord	71	14	41.2	2.97	2.0
New Hampshire—Con'd.					
Durham	72	11	41.4	3.47	1.8
Grafton†	70	0	36.9	3.69	1.0
Hanover	65	6	38.4	2.30	4.0
Keene	68	7	39.6	2.37	2.0
Lancaster	64	− 6	34.5	3.64	9.7
Nashua	69	12	40.8	2.52	2.5
Newton†	69	12	41.0	3.22	3.0
North Conway	69	− 4	37.1	5.40	8.0
Peterboro	66	4	39.8	2.40	1.0
Plymouth	67	− 1	35.9	5.26	5.5
Sanbornton†	68	8	37.8	4.01	2.0
Stratford	68	− 2	37.1	3.60	10.0
Warner				3.56	2.0
West Milan	66	− 9	35.4	3.38	7.0
New Jersey.					
Allaire	74	25	52.0		
Asbury Park	66	28	47.3	2.18	3.0
Atlantic City					4.5
Barnegat	83	24	52.3	1.37	2.0
Bayonne	74	33	48.5	2.80	6.0
Beachhaven*	71	28	49.1	1.40	3.0
Belvidere	71	19	45.1	4.50	
Beverly†	78	25	49.4	3.12	3.1
Billingsport*[1]	72	28	47.7	3.43	1.8
Blairstown	69	21	44.0	4.40	T.
Boonton	71	20	45.8	4.08	1.7
Bridgeton	75	29	51.4	2.37	1.0
Camden	73	25	49.0	3.01	3.0
Cape May	73	28	52.1	2.15	3.0
Cape May C. H.†	75	28	52.4	2.05	2.0
Charlotteburg	70	15	45.6	5.68	1.0
Chester	68	21	44.8	5.36	3.0
Clayton	76	26	49.7	2.00	1.0
College Farm†	74	25	48.8	2.95	3.5
Deckertown	72	19	45.4	3.62	
Dover	72	12	44.2	4.45	2.0
Egg Harbor City	75	28	49.4	2.13	2.5
Elizabeth†	75	24	47.5	2.35	8.5
Englewood	74	18	45.2	2.94	3.5
Franklin Furnace	70	24	43.9	4.00	T.
Freehold	74	26	48.8	3.66	
Friesburg				2.27	1.5
Gillette	74			2.77	5.0
Hammonton				2.24	2.5
Hanover	70	20	47.2	2.50	2.0
Hightstown	73	25	48.1	3.28	5.0
Imlaystown	74	24	50.2	3.05	2.3
Junction				4.47	2.8
Lambertville	72	23	47.2	4.01	4.8
Moorestown	77	24	50.2	3.18	4.5
Newark *a*	72	28	48.8	2.89	
Newark *b*†	74	25	47.9	3.14	3.5
New Brunswick *a*	76	24	49.0	3.40	6.7
New Brunswick *b*	74	23	47.1	3.24	6.0
Newton	70	20	43.8	4.50	0.3
Ocean City	72	28	51.0	1.43	3.0
Oceanic	74	30	50.5	3.32	4.0
Paterson	77	23	48.6	3.44	4.0
Perth Amboy	74	24	47.8	2.98	5.0
Plainfield	73	23	47.7	2.96	5.0
Rancocas				2.93	4.2
Readington*[5]	76	26	52.1		
Rivervale	72	16	44.3	3.09	5.0
Sergeantsville*[1]	72	23	46.3	4.00	5.0
Somerville	74	20	47.6	3.26	
South Orange	71	25	47.0	3.03	3.0
Staffordville				1.98	3.5
Toms River	75	24	49.9	2.27	3.0
Trenton	76	27	52.8	2.66	3.0
Vineland	75	24	50.0	2.15	0.8
Woodbine	75	20	48.3	1.70	4.5
New Mexico.					
Albert†	77	12	44.6	0.43	
Albuquerque†	65	15	42.8	0.05	
Alma†	78	17	46.2	0.27	
Aztec†	66	− 2	36.2	0.32	1.0
Bernalillo†	70	7	40.0	T.	
Bluewater†	66	0	37.4	T.	T.
Chama†	75	−11	35.0	2.15	14.5
Deming*[3]	78	23	52.7	0.25	
East Lasvegas†	72	6	41.7	0.02	0.1
Eddy	87	27	56.0	0.00	
Engle†	73	17	46.0	0.15	
Espanola†	69	5	39.4	T.	T.
Fort Union	74	0	38.8	T.	T.
Galisteo†	66	8	39.8	0.00	
Gallinas Spring†	74	8	43.0	0.04	
Gila	74	12	49.0	0.44	
Hillsboro†	72	18	47.5	0.01	
Labelle†	61	−19	30.0	0.51	5.1
Las Cruces†	78	15	49.7	0.00	
Lordsburg*[3]	68	24	49.6	0.20	
Los Lunas†	72	11	43.8	T	
Lower Penasco†	78	15	49.2	T.	T.
Monero†	57	−12	29.6	1.06	5.5
Ocate†	68	0	38.4	0.20	2.0

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New Mexico—Cont'd.	°	°	°	*Ins*	*Ins.*
Puerto de Luna†	75	9	45.6	0.10	1.0
Raton†	65	0	34.6	T.	T.
Rincon†	75	19[b]	52.0[a]	0.12	
Roswell†	82	14	48.4	0.00	
San Marcial†	78	18	48.9	T.	
Santa Fe					1.5
Shattucks Ranch	72	10	47.0	0.17	T.
Socorro†	70	16	45.4	0.00	
Springer†	73	— 2	37.0	T.	T.
Valley Ranch	73	—10	38.3	T.	T.
White Oaks†	65	12	43.1	0.34	T.
New York.					
Adams				2.89	
Addison	76	20	44.3	0.83	0.2
Akron				2.53	
Albany					0.1
Alfred	67	16	41.1	2.15	4.5
Angelica†	68	18	41.6	2.08	3.0
Appleton	68	20	42.6	2.00	2.5
Arcade	67	16	41.2	3.68	6.7
Atlanta				1.82	
Avon	70	18	41.2	1.82	
Baldwinsville	69	13	42.6	3.07	T.
Bedford	74	17	45.4	4.69	4.0
Big Sandy*[10]	64	18	42.0		
Binghamton†	69	19	43.6	2.66	1.0
Binghamton W. B.					1.2
Bloomville	70	10	43.0	3.86	0.2
Bolivar	68[a]	17[a]	41.5[c]	1.42	T.
Boyds Corners				3.36	
Brentwood	72	19	46.2	5.10	5.5
Brooklyn	72	28	48.7	3.06	5.0
Buffalo					0.2
Canton†	66[a]	— 6[a]	37.0[a]	3.26	5.0
Carmel	70	17	43.6	3.43	2.0
Catskill	67	20	44.2	3.46	0.8
Charlotte*[10]	64	20	40.3		
Cherry Creek				4.09	
Cooperstown†	68	17	41.1	3.56	0.1
Cortland	68	19	42.8	3.17	
De Kalb Junction				2.76	
Dempster				3.33	
Easton				4.30	
Elmira†	73	22	45.2	1.40	
Fleming	70	18	44.0	2.88	2.0
Fort Niagara†	70	20	44.0	1.86	
Franklinville	67	17	41.8	3.18	4.6
Friendship	69	18	42.2	2.29	1.6
Fulton				4.11	
Glens Falls	66	13	40.2	5.55	1.0
Gloversville	65	10	39.6	5.37	1.0
Haskinsville				1.46	
Honeymead Brook	69	15	41.8	2.34	2.0
Humphrey†	71	16	41.6	2.93	9.9
Ithaca	69	22	44.7	2.00	T.
Jamestown	67	18	42.8	3.70	7.0
Kings Station				6.17	
Lake George	66	13	41.2	5.18	2.0
Lebanon Springs	65	12	40.6	3.15	2.0
Lockport	68	18	42.6	2.12	T.
Lowville	66	4	39.0	5.23	13.0
Lyons	70	21	43.8	3.34	1.5
Madison Barracks†	69	13	41.2	2.96	6.0
Manhattan Beach†	71	26	47.8	2.10	6.0
Mohonk Lake	64	21	42.8	4.79	T.
Mount Morris				2.60	T.
Newark Valley				2.21	
New Lisbon	68	14	39.6	2.96	2.5
New York					3.8
Niagara Falls				2.66	
North Hammond†	64	13	41.1	2.31	3.5
North Lake	61	6	36.0	6.21	2.0
Number Four†	63	7	37.2	4.75	11.5
Ogdensburg	70	11	39.8	2.58	4.4
Oneonta	70	19	45.4	2.20	
Oswego					5.6
Oxford	65	16	40.1	2.66	T.
Palermo†	67	18	41.2	3.60	
Perry City	67	14	41.0	2.44	6.0
Phœnix				4.27	
Pine City				0.98	
Pittsford	71	18	43.1	2.28	4.0
Plattsburg Barracks†	64	6	38.9	2.19	
Fort Jervis	68	18	43.3	5.31	T.
Potsdam	69	3	37.1	2.02	3.0
Poughkeepsie	71	16	43.2	1.45	T.
Primrose	74	18	45.8	2.91	T.
Ridgeway				2.38	
Rochester					5.5
Rome	64	11	39.1	5.06	
Romulus	70	20	44.2	2.92	3.2
Rose				3.64	
St. Johnsville				2.45	1.0
Saranac Lake	65	—1	35.8	2.80	8.5
Setauket†	69	29	48.4	3.21	3.0
Sherwood				2.14	
Skaneateles				2.73	
South Canisteo	70	14	43.0	1.82	2.1
Southeast Reservoir				3.38	
South Kortright†	67	13	39.8	2.83	1.0
Straits Corners	67	18	41.2	2.95	4.0
Tyrone				0.60	
Wappingers Falls	77	20	45.4	3.17	0.2
Warwick				3.67	
Watertown	78	13	41.2	4.42	
Watkins				1.67	
Waverly†	71	18	44.4	2.58	3.3
Wedgwood	69	17	42.2	2.03	2.0
Westfield	70	20	44.8	4.81	3.5
Westpoint†	73	20	45.5	5.10	0.8
Willetspoint	73	23	47.1	2.62	0.3
North Carolina.					
Asheville†	73	21	50.8	5.57	
Beaufort†	75	36	61.5	2.58	
Biltmore†	74	22	50.5	5.57	
Bryson City†				8.05	
Chapelhill†	79[a]	29[a]	55.0[a]	3.09	
Edenton†	81	30	57.0	3.76	
Experimental Farm	78[a]	29[a]	54.8[a]	3.58	
Fairbluff†				4.76	
Fayetteville†	83	26	57.0	2.51	
Flatrock	68[1]	23[1]	48.8[1]		
Goldsboro†	82	28	56.8	2.51	
Greensboro†	79	31	56.9	4.11	
Henderson†	79	28	54.4	2.04	
Highlands	66	15	47.8	11.74	
Horse Cove†	69	23	50.8	12.15	
Jacksonville†	85	27	58.6	3.51	
Lenoir*†[1]	72	30	51.4	6.61	
Linville†	64	20	45.2	6.74	T.
Littleton†	77[a]	24[a]	53.5[a]	2.33	
Louisburg†	77	27	54.2	2.85	
Lynn*†[2]	74		51.0	10.21	
Marion	77	26	54.8	9.60	
Mocksville	83	30	57.6	5.59	
Moncure†				4.04	
Monroe†	76	28	55.8	3.37	
Morganton*†[1]	70	30	48.1	6.47	
Mountairy†	74	24	51.4	7.05	1.0
Mount Pleasant	76	27	55.5	4.61	
Murphy†				8.71	
Newbern†	86	36	63.1	1.52	
Oakridge†	74	29	53.6	4.44	
Pantego				2.25	
Pittsboro†	77	26	53.2	4.73	
Raleigh*[1]	78	33	56.5	2.40	
Rockingham†	80	30	57.6	3.94	
Roxboro†	77	26	54.2	3.65	
Salem†	75	29	53.4	3.78	
Salisbury†	79	31	55.9	4.35	
Saxon†	76	25	53.2	5.29	2.0
Selma	82	28	56.4	3.05	
Settle	76	28	53.0	4.74	
Skyuka	75	28	52.3	10.76	
Sloan†	84	27	58.5	4.22	
Soapstone Mount†	83	21	53.0	4.39	
Southern Pines *a*†	80	32	59.6	4.89	
Southern Pines *b*	80	29	58.6	4.27	
Southport†	79	32	60.9	4.07	
Springhope*[1]	78	30	52.2	2.55	
Tarboro	82	26	55.6	4.94	
Wash Woods†				2.30	
Waynesville†	71	21	50.0	6.20	
Weldon†	78	25	52.9	1.79	
Wilkesboro	73	23	50.0	4.40	
Willeyton	80	27	54.5	3.80	
North Dakota.					
Amenia	32	—29	8.8	1.67	16.5
Ashley†				1.14	11.4
Bismarck					31.0
Buxton	33	—27	9.8	1.62	
Churchs Ferry	40	—28	4.8	2.30	23.0
Coalharbor†	32	—21	5.4	3.17	31.7
Dickinson†	50	—23	8.2	2.65	26.5
Ellendale				3.40	34.0
Falconer	46	—27	6.8		
Fargo†	33	—32	8.6	0.70	
Forman†	37	—28	10.8	1.07	20.2
Fort Yates†	45	—21	10.6	3.60	36.0
Gallatin†	33	—30	7.0	1.81	18.0
Glenullin	40	—24	5.6	2.40	24.0
Grafton†	32	—28	7.8	2.50	25.0
Grand Rapids†	35	—24	9.8	3.40	34.0
Hamilton	37	—32	7.4	2.92	16.2
Jamestown†	35	—20	10.4	3.50	35.0
Kelso	40	—30	12.0		
McKinney	33	—30	4.4	1.80	30.0
Mayville†	35	—24	10.2	4.33	41.3
Medora†	62	—31	9.2	1.02	13.5
Milton†	34	—27	6.6	2.00	20.0
Minto†	37	—28	9.6	0.74	7.4
Napoleon†	38	—25	6.6	2.60	26.0
New England City†	50	—12	15.5	2.80	28.0
Oakdale†	47	—18	10.4	2.30	23.0
Portal†	35	—26	3.8		20.0
Power†	34	—24	11.5	1.83	16.0
St. John†	32	—25	6.0	3.30	33.0
Sheyenne	34	—25	5.9	2.60	26.0
Towner†	31	—30	4.6		
University†	41	—25	10.5	2.10	21.0
Valley City†[1]	30	—17	9.6	1.20	12.0
Wahpeton†	39	—25	15.3	0.75	7.5
Wildrice†[2]			9.9	1.60	16.0
Williston					30.5
Willow City†	32[c]	—30[c]	3.0[c]	1.20	12.0
Woodbridge†	31	—28	5.6	1.07	
Ohio.					
Akron	70	16	44.2	1.77	0.8
Annapolis	72	15	44.0	3.16	T.
Ashland	69	11	41.9	2.18	0.2
Ashtabula	73	20	45.0	3.18	1.0
Atwater				1.65	0.1
Auburn	68	19	40.2	2.05	4.0
Bangorville	68	9	43.2	2.34	T.
Basil				4.06	
Bellefontaine	79	12	45.4	0.93	T.
Bement				2.84	1.0
Benton Ridge	73	9	44.4	1.94	T.
Berlin Heights[f]	72	13	41.8		
Bethany	71	14	47.3	3.63	
Bigprairie	70	12	43.4	1.67	T.
Binola	73	17	46.5	2.05	3.0
Bissells	79	17	45.0	2.04	2.9
Bloomingburg	74	13	46.3	3.35	T.
Bowling Green	72	11	42.9	2.00	
Cambridge	73	10	45.0	3.52	
Camp Dennison	71	16	47.0	3.83	T.
Canal Dover	71	15	44.0	2.21	
Canton†	75	15	45.7	1.94	T.
Carrollton	71	14	45.0	2.64	T.
Cedarville				3.07	
Celina	73	13	46.5	1.46	
Cherryfork	73	11	45.2	4.20	T.
Cincinnati					T.
Circleville *b*	75	17	46.8	1.74	
Clarksville	71	13	46.4	3.82	
Cleveland *a*	70	20	45.2	2.23	1.0
Cleveland *b*	70	14	45.2	1.59	T.
Cleveland (W. B)					0.3
Clifton	72	10	44.6	3.80	T.
Coalton	74	15	45.3	2.81	
Colebrook	69	16	43.9	2.38	5.0
Columbus					T.
Dayton *a*	70	12	46.8	3.12	T.
Dayton *b*†				1.78	
Defiance	71	10	43.6	2.05	T.
Delaware†	69	13	45.4	2.26	
Demos	72	18	45.1	2.70	T.
Dupont	72	9	43.2	1.76	T.
Elyria	73	17	44.2	1.95	0.5
Fairport Harbor*[10]	72	27	46.9		
Fayetteville	70	14	45.4	5.50	T.
Findlay	74	8	43.8	1.14	T.
Fostoria	71	11	43.7	1.76	T.
Frankfort	71	16	46.8	3.60	T.
Garrettsville†	71	17	44.8	1.95	2.0
Granville	73	14	44.2	4.13	T.
Gratiot	71	15	45.0	3.48	T.
Greenfield	68	22	47.9	5.49	
Greenhill	71	12	43.5	1.46	0.1
Greenville	67	11	43.8	2.73	T.
Hackney				1.71	T.
Hanging Rock	77	18	49.2	2.98	
Hillhouse	73	16	43.0	4.03	7.0
Hillsboro†	76	15	47.6	4.58	T.
Hiram	69	16	43.2	1.97	2.0
Hudson	70	16	44.2	2.30	T.
Jacksonboro	71	11	44.4	2.70	
Kenton†	73	10	44.2	2.29	T.
Killbuck	71	11	43.8	2.84	T.
Lancaster	71	17	44.4	3.37	
Leipsic	71	9	41.5	1.74	T.
Levering	70	6	40.6	2.62	
Logan	73	10	47.3	3.68	T.
Lordstown	73	15	44.0	1.60	0.5
McArthur	74	16	45.8	3.64	T.
McConnelsville†				3.14	T.
Marietta *a*†				2.72	
Marietta *b*	78	22	47.8	2.92	T.
Marion	76	9	44.7		T.
Medina	72	15	44.2	1.95	1.0
Milfordton	72	10	42.6	3.07	T.
Milligan	75	15	46.1	2.92	
Millport				1.85	T.
Montpelier	68	13	40.1	2.33	T.
Napoleon	70	11	42.4	2.41	T.
Neapolis				1.99	T.
New Alexandria	71	17	46.7	3.85	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
New Berlin	70	28	44.1	2.04	.....
New Bremen	78	9	43.0	1.26	.....
New Comerstown	72	17	44.2	3.02	T.
New Holland	70	15	45.1	3.45	T.
New Moscow	.....	.....	.....	3.46	.....
New Paris	74	9	45.2	2.35	T.
New Waterford	.....	.....	.....	1.54	.....
North Lewisburg	75	11	44.4	2.45	.....
North Royalton	70	15	43.9	2.54	.....
Norwalk	76	10	44.8	1.00	.....
Oberlin	70	12	45.6	1.34	.....
Ohio State University	71	13	44.7	3.52	T.
Orangeville	70	17	42.6	1.75	3.0
Ottawa	74	12	45.4	1.76	T.
Pataskala†	73	14	45.1	4.34	T.
Perry	.....	.....	.....	2.93	1.0
Philo	72	14	45.2	2.47	T.
Plattsburg	71	12	44.6	3.29	T.
Pomeroy	75	20	47.7	2.14	T.
Portsmouth *a* †	.....	.....	.....	3.39	.....
Portsmouth *b*	78	18	49.7	3.30	.....
Richwood	.....	.....	.....	1.98	.....
Ridgeville Corners	77	11	42.6	2.37	T.
Ripley	79	15	47.4	4.23	.....
Rittman	72	12	42.6	2.20	T.
Rockyridge	74	15	43.6	2.02	0.4
Rosewood	67	10	44.2	2.37	T.
Sandusky	.....	.....	.....	.....	T.
Sharon Center	69	16	45.4	1.19	.....
Shenandoah	71	10	42.5	1.75	T.
Sidney *b*	74	12	44.0	2.99	.....
Sinking Spring †	74	16	46.2	4.77	T.
Springboro	.....	.....	.....	3.05	.....
Spring Valley	69	10	43.0	3.15	T.
Strongsville	.....	.....	.....	1.96	1.0
Sylvania	69	9	40.1	1.94	2.0
Thurman	79	16	49.2	2.61	.....
Tiffin †	69	14	44.2	1.58	0.1
Toledo	.....	.....	.....	.....	0.7
Upper Sandusky	72	12	44.4	1.69	T.
Urbana	67	14	42.8	2.74	T.
Vanceburg	75	16	47.4	2.76	.....
Van Wert	72	9	42.1	1.86	T.
Vermilion	72	13	43.7	1.43	0.5
Vickery	71	13	44.2	1.44	0.4
Walnut	.....	.....	.....	3.29	T.
Warren	72	18	44.2	2.11	1.0
Wauseon	70	12	42.4	2.25	1.0
Waverly	75	16	47.5	3.64	T.
Waynesville	.....	.....	.....	3.00	T.
Westerville	70	15	45.4	2.89	T.
Wooster *a*	69	13	44.4	1.78	T.
Youngstown	69	18	44.3	1.60	T.
Oklahoma.					
Alva †	80	7	43.8	0.59	
Anadarko †	83	14	49.0	1.25	
Arapaho †	81	6	44.6	0.65	
Beaver †	78	0	38.5	0.19	T.
Burnett †	82	14	48.4	3.48	
Clifton †	82	8	47.4	3.31	T.
Edmond	.....	.....	.....	2.08	
Fort Reno †	81	11	44.8	1.30	
Fort Sill	83	15	48.7	1.83	
Guthrie †	73	12	46.7	2.11	
Hennessey †	78	.....	.....	1.10	T.
Mangum †	85	13	49.3	0.61	
Norman †	91	13	47.6	3.20	
Pondcreek †	85	6	46.6	0.38	
Prudence †	83	8	46.6	0.66	
Sac and Fox Agency †	81	10	47.9	3.00	
Stillwater †	80	12	46.4	1.56	
Winnview †	80	8	45.7	0.41	
Oregon.					
Ashland *b*	70	15	40.6	5.43	2.1
Astoria	.....	.....	.....	.....	3.5
Aurora *a*	63	17	44.5	15.55	4.0
Aurora (near)	60	8	38.2	16.73	4.5
Baker City	.....	.....	.....	.....	7.0
Bandon	60	24	46.6	11.68	
Bay City †	59	18	43.2	18.59	
Brownsville	.....	.....	.....	9.52	3.0
Burns †	62	—26	26.7	1.00	10.0
Cascade Locks	64	6	37.6	23.65	17.0
Comstock	58	9	40.8	15.00	1.5
Corvallis *a*	59	10	38.6	16.60	2.5
Dayville †	66	— 4	37.2	1.43	0.5
Eugene † *a*	66	12	40.2	11.86	3.0
Falls City	.....	.....	.....	24.61	6.8
Fife †	61	—15	30.8	1.52	3.5
Forest Grove	60	7	37.5	18.37	5.0
Fort Klamath	55	—14	30.2	7.13	7.8
Gardiner	64	21	45.8	18.18	
Glenora	56	11	36.8	39.26	3.0
Government Camp	52	— 3	26.6	25.31	74.0
Grants Pass *a* †	67	15	42.2	6.31	0.4
Hood River (near)	60	— 6	31.2	16.55	44.5
Oregon—Cont'd.					
Hubbard	60	8	36.9	17.53	7.5
Irvington	.....	.....	.....	11.32	.....
Jacksonville	66	15	39.8	4.79	1.5
Joseph	58	—17	27.8	3.74	16.0
Junction City	72	15	44.0	13.96	2.5
Lafayette	65	13	40.5	17.05	4.5
Lakeview †	56	—14	31.8	2.96	13.0
Langlois	68	26	50.9	26.95	
McMinnville †	58	14	38.3	20.47	4.0
Merlin	66	10	40.1	8.21	
Monmouth	58	12	38.8	18.05	5.5
Mount Angel †	60	10	39.3	13.02	9.5
Nehalem	.....	.....	.....	26.32	1.5
Newberg	62	14	35.0	18.64	2.0
Newbridge	70	— 7	39.8	3.01	30.0
Newport	57	19	42.4	21.01	
Pendleton	71	—13	35.2	1.84	10.0
Portland	.....	.....	.....	.....	2.0
Riddles	64	14	42.4	8.09	
Roseburg	.....	.....	.....	.....	0.2
Salem *b* †	60	12	39.4	16.99	4.0
Sheridan	60	10	40.7	16.93	2.5
Silver Lake	68	—32	27.1	2.32	9.2
Silverton	58	10	38.1	15.70	6.5
Siskiyou	55	12	36.8	8.47	13.7
Sparta	59	—12	37.7	.....	.....
Stafford	59	11	38.0	19.27	6.5
The Dalles †	62	— 2	35.0	5.87	18.8
Toledo	66	9	40.6	18.72	1.2
Vale	70	—10	33.6	1.62	12.0
Vernonia	58	— 6	37.1	13.00	6.4
West Fork	62	18	44.0	12.09	
Weston	70	—15	31.1	4.33	14.0
Williams	63	13	41.6	6.74	.....
Pennsylvania.					
Altoona	73	23	50.3	2.59	T.
Aqueduct	76	20	46.2	3.47	T.
Beaver Dam †	.....	.....	.....	2.31	
Bethlehem	.....	.....	.....	2.34	.....
Blooming Grove	67	12	41.0	6.40	2.2
Brookville †	.....	.....	.....	3.13	1.0
Browers Lock	.....	.....	.....	3.56	.....
Cameron	.....	.....	.....	2.49	
Canonsburg	79	19	50.5	1.64	
Carlisle	77	23	47.2	3.59	T.
Cassandra	70	19	44.3	3.10	3.0
Centerhall †	70	21	45.9	3.11	T.
Chambersburg †	74	19	45.6	4.20	
Coatesville	77	21	47.7	4.25	4.9
Confluence †	83	21	44.2	3.88	
Coopersburg	78	24	49.1	4.87	1.1
Davis Island Dam †	.....	.....	.....	2.88	
Derry Station	75	21	46.6	2.95	
Doylestown	.....	.....	.....	3.96	.....
Driftwood	.....	.....	.....	1.90	T.
Duncannon	.....	.....	.....	4.48	
Dyberry †	70	17	40.7	3.42	0.5
East Bloomsburg	.....	.....	.....	5.00	
East Mauch Chunk	73	19	44.6	6.74	
Easton	68	24	45.8	4.46	T.
Edinboro	70	17	41.4	.....	2.0
Ellwood Junction †	.....	.....	.....	1.95	T.
Emporium	70	20	44.4	3.60	2.3
Erie	.....	.....	.....	.....	3.5
Farrandsville	.....	.....	.....	3.44	.....
Forks of Neshaminy	70°	30°	49.8°	4.55	4.0
Frederick	.....	.....	.....	3.80	.....
Freeport †	.....	.....	.....	3.58	T.
Girardville	.....	.....	.....	8.05	0.2
Grampian	70	16	43.1	3.26	1.0
Greensboro †	75	19	46.6	3.13	T.
Hallstead †	69	18	42.8	3.28	1.0
Hamburg	73	25	47.2	4.75	
Harrisburg	.....	.....	.....	.....	0.1
Hollidaysburg	75	20	45.7	1.73	T.
Huntingdon *a* †	78	20	47.6	3.40	
Huntingdon *b*	.....	.....	.....	3.04	
Indiana	74	14	46.8	4.45	.....
Irwin	79	18	49.6	2.84	T.
Johnstown †	69	18	45.3	3.70	T.
Keating	.....	.....	.....	2.18	
Kennett Square	76	25	49.4	4.33	5.0
Lancaster	75	18	52.4	.....	.....
Lansdale	.....	.....	.....	3.88	.....
Lawrenceville	72	19	45.3	.....	.....
Lebanon	73	21	46.3	4.76	0.4
Leroy †	71	17	43.2	2.92	0.5
Lewisburg	73	22	45.2	5.35	
Lock Haven *a* †	78	22	47.7	3.05	T.
Lock Haven *b*	.....	.....	.....	2.64	.....
Lock No. 4 †	.....	.....	.....	2.66	
Lycippus	74	19	48.0	3.10	
Mifflin	.....	.....	.....	3.60	
Oil City †	.....	.....	.....	2.50	1.4
Ottsville	.....	.....	.....	4.17	.....
Parker †	.....	.....	.....	2.52	T.
Pennsylvania—Cont'd.					
Philadelphia *b*	75	29	50.4	3.00	3.6
Philadelphia (W. B.)	.....	.....	.....	.....	2.8
Pittsburg	.....	.....	.....	.....	T.
Point Pleasant	.....	.....	.....	3.37	.....
Pottstown	76	24	48.4	4.28	2.0
Quakertown	73	19	46.0	4.51	2.0
Reading	.....	.....	45.2	3.45	.....
Renovo *a*	.....	.....	.....	2.49	T.
Renovo *b*	73	22	44.4	2.34	.....
Ridgway †	.....	.....	.....	2.41	1.0
Saegerstown	78	16	43.4	3.71	3.5
St. Marys	68	18	41.6	3.02	2.0
Salem Corners	74	21	44.4	4.22	1.6
Scranton	72	22	45.2	3.13	1.0
Seisholtzville	.....	.....	.....	5.77	.....
Selinsgrove	77	22	46.5	3.47	T.
Shawmont	.....	.....	.....	3.42	2.1
Shinglehouse	71	16	42.4	2.87	3.0
Sinnamahoning	.....	.....	.....	1.93	
Skippack	75	17	47.2	.....	4.0
Smethport	71	16	41.8	2.41	T.
Smiths Corners	.....	.....	.....	4.28	.....
Somerset	70	15	44.4	3.84	2.0
South Bethlehem	73	26	47.2	.....	.....
South Eaton	71	21	45.0	4.16	0.5
State College	71	21	46.3	3.11	T.
Sunbury	.....	.....	.....	3.30	
Swarthmore	.....	.....	.....	3.58	4.0
Towanda	70	22	45.1	2.75	1.0
Uniontown	75	21	48.8	3.22	.....
Warren †	74	19	45.2	2.64	6.0
Wellsboro †	71	16	40.4	0.82	T.
West Chester	74	25	48.7	4.17	4.5
West Newton †	.....	.....	.....	2.49	T.
Westtown	71	26	48.8	2.98	T.
White Haven	70	19	43.6	5.49	T.
Wilkesbarre †	72	23	45.9	3.44	T.
Williamsport	73	25	44.5	2.55	T.
York †	74	21	47.6	3.00	1.3
Rhode Island.					
Block Island	.....	.....	.....	.....	0.4
Bristol	65	21	46.5	3.33	3.5
Kingston	70	18	45.3	4.52	5.0
Lonsdale	.....	.....	.....	3.99	5.1
Narragansett Pier	.....	.....	.....	.....	3.0
Pawtucket	71	24	46.2	3.34	5.0
Providence *a*	70	21	47.0	3.37	5.5
Providence *b*	71	20	46.4	3.62	6.5
South Carolina.					
Anderson †	.....	.....	.....	7.46	
Batesburg †	78	38	57.4	3.00	
Blackville †	82	33	59.6	1.48	
Camden †	.....	.....	.....	2.88	
Central †	77	27	55.2	4.02	
Cheraw *a* †	90	27	58.0	2.55	
Cheraw *b* †	.....	.....	.....	3.16	
Clemson College	76	26	55.7	7.55	
Conway †	.....	.....	.....	4.43	
Darlington (near)	.....	.....	.....	4.18	
Edisto †	.....	.....	.....	3.35	
Effingham †	.....	.....	.....	3.61	
Florence †	80	28	57.4	4.39	
Georgetown †	83	33	60.8	3.95	
Gillisonville †	87	28	61.0	4.02	
Greenville †	78	29	55.6	9.48	
Greenwood	76	38	58.6	8.11	
Kingstree *a* †	83	28	59.2	2.38	
Kingstree *b* †	.....	.....	.....	2.32	
Little Mountain	84	34	61.3	3.27	
Longshore †	77	33	58.2	6.29	
Mount Carmel †	.....	.....	.....	8.17	
Pinopolis	79	35	58.7	2.63	
Port Royal †	78	40	63.5	2.75	
St. George †	84	31	59.6	2.15	
St. Matthews †	83	33	60.4	1.12	
St. Stephens †	.....	.....	.....	3.08	
Santuck †	77	30	56.0	4.55	
Shaws Fork	84	36	61.9	3.88	
Smiths Mills †	.....	.....	.....	3.32	
Society Hill †	79	30	57.2	3.91	
Spartanburg †	77	30	57.0	7.17	
Statesburg †	78	35	59.3	3.22	
Trenton	78	36	62.2	3.08	
Trial †	84	29	62.3	2.23	
Winnsboro	82	34	58.3	3.20	
Yemassee †	84	32	60.4	1.83	
Yorkville	78	35	58.5	4.45	
South Dakota.					
Aberdeen †	42	—25	9.6	.....	32.6
Alexandria †	54	—15	16.7	1.55	9.0
Armour †	52	—15	11.6	2.19	16.0
Ashcroft †	60	—26	16.0	1.90	19.0
Brookings	46	—17	17.3	0.78	5.0
Canton †	54	—10	20.0	2.52	10.5
Castlewood †	46[4]	—20[4]	12.3[4]	1.61	4.5
Chamberlain †	49	—16	16.0	0.45	9.0

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cross †*	65	— 5	28.0	0.92	12.9
Edgemont				0.57	
Farmingdale				0.96	6.4
Faulkton a †	41	—25	10.2		
Flandreau †	53	—14	18.0	2.01	8.8
Forestburg †	46	—18	15.8	1.42	13.2
Forest City †	45	—18	15.6	2.80	28.0
Fort Meade †		—10		1.27	11.6
Gary †	52	—15	15.3	1.98	12.0
Goudyville *†	45	—21	10.4	2.58	
Greenwood †	56	—11	21.0	1.68	13.2
Hotch City †	45	—21	14.7	0.92	10.0
Howard †	48	—18	16.0	1.43	9.5
Huron					16.7
Kimball †	45	—19	14.6	1.74	16.2
Leslie †	50	—25	15.1	1.90	21.5
Mellette †	39	—23	12.2	2.88	28.8
Menno †	60	—13	17.4	1.41	8.5
Millbank	43	—15	15.6	0.60	
Mitchell †	50	—16	16.8	1.92	6.0
Nowlin †	59	—22	16.4	1.00	10.0
Oelrichs †	70	—12	25.1	2.45	21.5
Parker †	53	—12	18.1	2.37	7.5
Parkston †	54	—18	15.2	0.60	
Pierre					20.1
Plankinton †	41	—16	13.3	0.97	17.0
Rapid City					10.6
Rochford				2.00	20.0
Rosebud †	66	—23	20.6	1.60	16.0
St. Lawrence †	48	—24	13.4	1.65	18.0
Silver City				1.55	15.5
Sioux Falls †	53	—12	18.2	1.97	8.8
Spearfish †	66	—11	21.2	0.78	11.8
Tyndall †	60	—10	19.2	1.10	11.0
Watertown †				1.30	12.0
Webster †	40	—29	8.8	2.34	13.1
Wentworth †	47	—16	16.2	1.58	8.0
Yankton †	47	— 9	19.8	2.29	
Tennessee.					
Andersonville *†	75	22	50.6	6.40	
Ashwood *†	76	19	53.3	7.60	
Benton (near) †	77	21	53.4	5.89	
Bolivar †	76	17	51.7	7.29	T.
Bristol †	73	15	48.2	5.47	T.
Cagle *†	69	18	50.1	4.91	
Carthage †				8.01	
Clarksville	76	16	51.2	8.47	T.
Clinton †				7.41	
Cookeville	79	18	53.0	5.89	T.
Decatur †	75	21	52.2	7.59	T.
Dyersburg †	80	19	51.1	5.66	
Elizabethton †	78	25	51.7	4.67	T.
Elk Valley *†	73	25	49.8	5.50	T.
Fairmount *†	68	21	49.9	7.66	
Florence †	74	19	52.2	8.73	
Greeneville †	74	23	51.7	5.51	T.
Harriman	75[1]	23	51.5*	6.86	T.
Hohenwald †	75	16	50.8	6.41	
Jackson †	76	18	51.2	6.19	T.
Johnsonville †		13		8.42	
Jonesboro *†	71	23	49.2	5.66	T.
Liberty †	75	21	53.0	7.56	T.
Loudon †				6.03	
Lynnville *†	75	19	51.4	6.67	T.
McKenzie *†	74	16	50.6	6.21	
McMinnville †	73	22	53.2	8.41	T.
Molino †	72	19	50.2	9.76	
Newport †	79	23	51.8	4.90	T.
Nunnelly *†	77	17	52.3	6.69	
Palmetto †	76	19	54.9	6.79	
Pope *†	78	20	52.2	6.98	
Riddleton †	74	20	51.6	7.57	
Rockwood †				9.23	
Rogersville †	74	26	50.5	5.30	0.5
Rugby *†	72	20	49.3	6.02	T.
St. Joseph †	78	18	53.3	7.44	
Sewanee †	73	18	48.9	6.71	T.
Springdale *†	80	27	52.0	3.79	1.0
Tellico Plains †	77	21	53.0	5.32	
Trenton	75	16	50.6	8.37	
Tullahoma †	72	18	50.8	6.32	0.2
Union City †	76	16	50.0	5.67	
Waynesboro *†	78	18	52.3	5.17	
Texas.					
Alice †	88[2]	29[2]	62.8[2]	1.60	0.5
Arthur City †				4.42	
Austin δ *‡	80	26	57.4		
Ballinger †	80	23	53.4	0.27	
Beeville †	80	33	64.3	0.34	
Blanco †	80	24	57.6	T.	
Boerne *†	80	26	58.2	0.31	
Brazoria †	85	38	66.4	5.26	
Brenham †	86	30	62.2	4.12	T.
Brighton †		32		1.71	T.
Burnet *†	78	20	56.8	0.44	
Camp Eagle Pass †	92	32	65.0	0.42	3.2

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Texas.—Cont'd.	°	°	°	*Ins.*	*Ins.*
Childress	84	14	50.0	0.64	
Coleman *‡		20	52.2	0.41	
College Station	81	29	59.5	1.45	T.
Colmesneil				4.27	
Columbia †	85	35	64.7	4.17	
Corpus Christi					T.
Corsicana δ †	86	18	55.6	2.21	
Cuero †	84	30	62.0	0.79	T.
Dallas †	81	22	54.0	1.05	
Danevang †	86	33	63.4	1.72	T.
Dublin †	82	20	53.4	0.48	
Duval *‡	86	29	62.4	T.	
Estelle †	83	21	54.8	0.88	
Forestburg †	81	30	52.6	2.40	
Fort Brown †	89	30	68.0	4.09	
Fort Clark	82	26	61.8	1.07	T.
Fort McIntosh	84	27	62.4	0.76	4.0
Fort Ringgold †	91	32	68.0	0.42	
Fort Stockton				0.28	1.0
Fort Worth †	82*	18*	56.2*	1.27	
Fredericksburg *†	81	25	57.4	0.41	
Gainesville †	83	22	53.3	4.25	
Georgetown *‡	80[c]	26*	53.6[c]	0.29	
Golindo				0.75	
Graham	84[1]	19[1]	53.0[1]	0.55	
Grapevine †	83*	22*	53.2*	1.54	
Hale Center †	88	30	51.0	0.45	
Hallettsville †	86	32	62.7	0.97	T.
Haskell	75	13	49.2	1.60	
Henrietta †	80	18	53.3	1.95	
Houston †	85	38	65.0	1.99	
Huntsville †	85	33	61.2	2.42	
Kent				0.14	
Kerrville †	80	23	56.6	0.36	
Lampasas †	84	22	58.6	0.18	
Llano *†	84	25	58.0	0.40	
Longview †	84	30	60.0	2.15	
Luling †	85	30	62.8	1.17	
Menardville †	80	13	52.0		
Moore Station	86	32	63.8	0.02	
Mount Blanco *†	81*	12	46.8	0.06	
New Braunfels †	80	32	60.2	0.00	
Orange †	85	33	61.8	3.39	
Panter †				1.28	
Paris †	82	21	55.2	1.87	
Point Isabel *‡	84	32	71.3	1.05	
Rheinland †	85	18	52.4	1.57	
Roby †		14		0.32	
Rocksprings				0.45	0.5
Round Rock *†	82	28	59.6	0.70	
Runge †	89	30	65.4	T.	T.
San Antonio (W. B.)					T.
Sanderson †	82	21	57.0	0.50	2.0
San Marcos a †				0.47	
San Marcos δ †	80	30	60.4	0.56	
Sierra Blanca †	80	7	54.8	T.	T.
Stafford †	86	32	62.7	4.06	
Sulphur Springs †	83	23	57.0	2.54	
Tyler †		29		0.65	
Waco †	80	24	57.2	0.93	
Weatherford †	82	20	53.7	0.91	
Wichita Falls †				1.93	
Utah.					
Alpine City †				1.40	2.0
Blue Creek *‡	60	0	32.6		
Brigham City †				2.32	
Cisco †	71	11	38.8	0.03	
Corinne *‡	73	— 6	37.5	1.19	4.5
Fillmore †	75	—11	38.2	1.17	
Fort Duchesne †	58	— 9	30.3	0.20	2.0
Giles †	66	— 5	35.4	T.	
Grover †	63	—11	33.0	0.30	3.0
Huntsville †				3.49	1.0
Levan †	62	—10	34.8	1.58	11.0
Loa †	62	—18	29.0	0.34	2.0
Logan †	65	—11	34.1	1.97	
Mammoth †	58	— 6	33.5	1.09	10.5
Manti †	68	— 8	33.8	0.30	3.0
Milville †				2.12	
Moab †	68	11	39.4	0.30	T.
Mount Pleasant *†	60	0	33.1	1.75	11.0
Ogden a *‡	60	— 2	36.6	1.93	2.0
Park City †	55	—10	27.1	2.25	27.0
Parowan †	66	— 7	35.2	0.30	2.2
Promontory *‡	53	—12	30.5	1.10	3.5
Richfield †	68	— 6	36.4	0.63	3.0
St. George †	78	4	40.7	0.26	
Salt Lake City					11.1
Scipio †	66	—12	32.2	1.14	4.0
Snowville †	52	—12	30.0	1.97	3.0
Soldier Summit †	47	—20	20.6	3.25	32.5
Terrace *‡	59	— 8	30.1	0.32	3.2
Thistle †	42	4	25.8	0.70	7.0
Tooele †	67	— 4	35.8	2.07	
Vernal †	52	— 1	32.1	0.42	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Vermont.	°	°	°	*Ins.*	*Ins.*
Bennington	68	16	42.1	2.61	T.
Burlington †	66	12	42.0	2.43	3.0
Chelsea †	62	3	36.8	3.03	4.0
Cornwall	65	10	41.0	2.58	4.0
Enosburg Falls	66	— 5	39.0	3.58	5.5
Hartland †	69	3	38.0	3.52	2.0
Jacksonville	61	15	37.9	3.67	1.3
Northfield					4.3
Norwich	67	0	37.6	3.01	3.0
St. Johnsbury	62	— 3	37.0	3.45	8.0
Strafford *†	63	8	36.0	3.35	5.0
Vernon *‡	68	11	41.7	3.86	1.5
Wells	66	11	39.4	3.36	1.0
Woodstock	68	2	37.8	3.20	2.0
Virginia.					
Alexandria	74	21	49.7	2.49	0.8
Ashland †	81	24	53.1	2.42	1.5
Barboursville	74	26	52.0[f]	4.02	1.0
Bigstone Gap †	75	18	46.6	4.48	0.2
Birdsnest *†	80	32	55.4	1.95	T.
Blacksburg	72	19	47.0	4.52	1.0
Buckingham †	75	16	49.0	3.79	T.
Burkes Garden	65	20	44.2	6.16	
Callsville †	77	26	52.8	1.98	
Christiansburg †				3.72	0.5
Clifton Forge	70	25	44.6	5.56	0.1
Dale Enterprise †	73	20	47.8	4.30	4.0
Doswell	75	30	49.8	2.10	
Fredericksburg †	75	29	51.6	2.60	1.0
Goshen	82	29	52.8	2.95	1.0
Grahams Forge	71[4]	21[4]	46.8[4]	4.77	T.
Guinea	74	25	55.9	3.97	
Hampton	75	33	56.4	2.17	
Hot Springs	70	10	47.2	5.16	2.0
Lexington †	76	25	50.9	5.35	1.0
Lynchburg					2.0
Maidens	78	25	52.8		
Manassas †	76	24	51.0	2.47	1.0
Marion †	71[4]	25[4]	49.0[4]	5.60	T.
Nottoway †	83	25	54.8	5.59	1.0
Petersburg †	80	29	55.8	2.53	1.8
Quantico	75	28	49.5		
Richmond (near) †	83	25	55.3	3.27	
Rockymount †	74	30	54.6	5.60	2.0
Salem †	80	30	55.5	5.16	T.
Saltville	75	21	48.6	5.42	
Smithville †	73	29	53.4	3.49	2.0
Spottsville †	77	27	52.2	1.97	T.
Stanardsville †	75	20	50.3	5.34	1.0
Staunton †	76	24	52.4	5.01	2.0
Stephens City †	75	18	49.3	2.92	0.8
Sunbeam †	77	28	53.4	2.92	
Warsaw †	76	27	52.2	2.57	1.5
Westbrook Farm	75	28	52.4		
Woodstock †	79	14	48.8	3.20	4.0
Washington.					
Anacortes				6.16	9.0
Ashford †				16.15	8.5
Blaine †	54	— 3	30.5	9.32	4.2
Cascade Tunnel † *	44	—14	34.4	12.90	115.0
Centerville †	62	—24	29.8	7.29	22.0
Chehalis †	59	5	36.7	12.19	9.0
Colfax †	62	—10	30.8	6.16	11.2
Connell †	70	—17	33.0		10.0
Coupeville †	57	12	37.0	3.60	5.0
Eastsound †	57	14	38.4	7.72	6.0
Ellensburg †	68	—29	23.8	3.45	
Elma	65	5	41.0	11.61	4.5
Fort Canby					2.0
Fort Simcoe †	61	—10	32.4	6.89	25.3
Fort Spokane	71	—25	27.2	3.20	20.8
Grandmound †	58	— 5	34.6	14.08	17.6
Hunters †	54	—18	22.4	4.76	26.3
Kennewick †	73	—12	36.3	1.50	12.0
La Center	58	9	37.8	14.28	4.5
Lakeside †	63	— 3	27.6	3.00	12.0
Lapush †	54	14	37.2	14.51	1.0
Loomis †	63*	—11*	24.8*	2.66	
Madrone *†	56	8	37.8	11.86	22.0
Mayfield †	56	8	36.3	16.19	
Montecristo †	50	— 1	30.8	17.50	85.0
Moxee Valley †	67	—22	29.7	1.61	2.4
New Whatcom †	58	4	34.2	6.35	5.5
North Bend *‡	58	10	36.4	18.55	18.0
Olga	56	14	36.5	7.13	7.5
Olympia †	60	4	37.6	13.98	8.0
Pine Hill †	59	— 9	33.3	9.95	27.9
Pomeroy †	62	— 7	34.9	3.65	9.8
Port Angeles					5.5
Pullman †	60	—12	29.8	6.81	15.0
Questa †	60	16	37.6		
Rosalia †	60	— 6	29.6	6.46	16.8
Seattle					20.5
Sedro †	63	5	36.5	9.55	6.0
Silvercreek *‡	56	9	35.8	14.32	8.0
Snohomish †	63	7	35.1	8.35	13.5

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Washington—Cont'd.	°	°	°	*Ins.*	*Ins.*
Southbend	70	16	43.4	15.65	T.
Spokane					16.5
Stillaguamish	58	2	34.1	4.65	11.0
Sunnyside†	66	—23	30.2	1.49	14.5
Tacoma†	60	8	36.4	9.79	8.4
Tatoosh Island					1.0
Union City†	63	9	37.6	19.39	13.0
Vashon†	59	15	38.4	11.24	14.0
Walla Walla					10.9
Waterville†	58	—21	25.5	3.10	20.5
Wenatchee Lake†	45	—11	24.8	7.85	57.0
West Ferndale†	57	11	34.2	10.80	3.5
West Virginia.					
Beverly†	76	16	46.1	3.92	2.0
Bloomery†	72	23	45.8	1.56	T.
Bluefield†	75	10	47.5	4.58	1.5
Buckhannon *a*†				5.01	0.5
Burlington†	75	22	49.0	3.60	0.3
Charleston†				3.73	
Creston†	73	19	52.9	2.82	
Dayton†				2.85	T.
Elkhorn†	74	24	51.7	4.71	2.0
Fairmont†				3.13	
Glenville†	75	20	47.4	3.86	
Grafton†	76	20	46.8	3.38	T.
Green Sulphur	74	25	50.4	3.49	
Harpers Ferry†				2.06	
Hewett†	76	22	49.0	4.50	0.1
Hinton *a*†				3.79	2.0
Hinton *b*†	76	22	49.1		1.5
Marlinton†	70	11	44.4	4.93	3.0
Martinsburg†	76	24	47.9	2.48	T.
Morgantown *a*†				4.18	
Morgantown *b*†	76	25	45.5	4.17	
New Martinsville†	78	22	50.0	3.32	
Nuttallburg†	79			3.50	
Oldfields†	78	22	47.8	2.86	0.2
Parkersburg					T.
Pennsboro	77	18	48.2	3.60	
Philippi†	80	24	53.4	4.33	T.
Point Pleasant†	74	20	48.1	2.87	
Powellton†	77	30	49.8	3.59	1.5
Rowlesburg†				2.20	
Tannery*‡	71	22	45.8		0.2
Weston *a*†				3.57	
Weston *b**‡	72	27	46.9		T.
Wheeling *a*†				1.57	T.
Wheeling *b*†	74	25	49.5	2.62	T.
White Sulphur Springs†	73	18	47.6	5.07	4.0
Wisconsin.					
Amherst	64	— 4	25.4	1.50	6.0
Antigo†	56	— 9	24.6	3.23	26.8
Apollonia *†‡	52	—12	24.3	6.74	14.2
Bayfield	39	—13	18.0	3.22	27.0
Beloit	68	— 1	34.8	1.53	13.5
Boscobel†	65	— 3	31.7	1.76	3.7
Centralia	65	— 6	27.8	1.90	8.0
Chilton	65	— 2	32.4	0.99	0.7
Citypoint	58			2.81	4.0
Crandon†	52	—15	24.2	5.20	17.0
Delavan†	68	0	33.6	1.42	8.0
Dodgeville†	67			1.58	2.0
Easton†	71	— 5	27.6	3.21	2.8
Eau Claire	60	— 7	28.4	3.70	13.0
Florence†	49	—10	26.8	4.66	21.0
Grand River Lock				2.06	4.0
Grantsburg†	61	—15	23.8	4.75	12.0
Gratiot†	70	— 1	31.7	1.45	
Greenbay					16.1
Hartford				3.03	17.5
Harvey	66	1	33.0	2.58	14.3
Hayward†	50	—18	19.9	2.70	15.1
Hillsboro	68	— 2	28.7	2.91	7.0
Koepenick *†‡	54	— 8	25.9	4.10	14.0
La Crosse					8.9
Lancaster†	70	— 4	28.8	1.69	3.0
Lincoln†‡			30.4	2.96	12.8
Madison†	65	— 1	31.8	1.40	1.4
Manitowoc†	65	0	32.0	2.94	11.8
Meadow Valley†	67	— 6	26.4	2.50	5.0
Medford†	55	—14	22.6	3.06	6.2
Menasha				1.35	11.0
Milwaukee					16.3
Neillsville†	56	— 6	25.8	4.27	12.0
New Holstein	62	— 2	33.5	4.54	18.0
New London	65	— 4	27.6	1.99	2.0
Oconto	57	— 1	30.4	5.21	16.5
Osceola†	50	—12	19.5	3.20	9.2
Oshkosh†§	64	— 2[n]	28.6	1.92	8.2
Pepin	58	— 9	21.8	2.97	16.0
Pine River†	69	— 5	28.8	2.63	4.7
Portage†	68	— 4	29.0	1.15	1.0
Port Washington	74	— 3	34.8	3.00	8.0
Prairie du Chien	71	— 2	33.7	2.23	3.5
Racine	69	— 3	36.7	1.80	4.0
Sharon†	68			2.49	8.0
Wisconsin—Cont'd.					
Shawano	58	— 2	28.8	2.34	12.0
Spooner†	50	—15	23.8	2.10	8.0
Stevens Point†	59	— 5	27.1	2.76	13.0
Sturgeon Bay Canal *[10]	50	0	31.8		
Valley Junction†	69	— 7	27.4	2.22	6.5
Viroqua	66	— 5	28.4	3.66	5.0
Watertown†	65	— 3	32.3	2.11	12.5
Waukesha†	66	0	33.1	2.05	14.7
Waupaca†	68	— 4	28.0	2.25	7.0
Wausau†	55	— 6	25.6	3.99	18.0
Westbend	66	2	33.6	1.98	13.6
Westfield†	65	— 4	28.3	1.57	3.0
White Mound†	73	— 3	31.1	1.64	
Wyoming.					
Big Horn Ranch	56	—27	21.5	0.77	11.1
Cheyenne					0.8
Fort Laramie†	70	—14	27.8	0.70	6.2
Fort Washakie†	66	—30	25.1	0.42	4.2
Fort Yellowstone†	50	—27	18.4	3.92	35.2
Lander					8.0
Laramie	60	—21	27.2	0.09	
Lusk†	62	—16	22.0	0.88	8.8
Sheridan	72	—18	19.6	1.85	13.5
Sundance	51	—15	18.1	1.20	12.0
Wheatland†	71	—14	28.6	0.85	8.5
Mexico.					
Ciudad P. Diaz	83	29	62.0	0.44	
Jalapa	84	43	66.0	5.20	
Leon de Aldamas	78	44	61.8	1.06	
Mexico	72	47	59.3	0.80	
Puebla	76	48	62.2	1.61	
Topolobampo *‡	86	60	74.5	0.14	
New Brunswick.					
St. John	55	9	36.3	6.07	5.6
West Indies.					
Grand Turk Island				1.99	

Late reports for October, 1896.

Alabama.	°	°	°	*Ins.*	*Ins.*
Livingston	86	35	61.9	2.48	
Alaska.					
Juneau	66	30	45.4	9.70	
Arizona.					
Dudleyville	89	40	64.6	5.95	
Lochiel *‡	80[n]	37[n]	58.4[n]	2.50	
Arkansas.					
Postelle				1.70	
California.					
McMullin *‡	92	42	67.5		
Needles	98	45	74.6	T.	
Ogilby	104	63	79.6		
Oroville *b*	94	50	72.1	0.90	
Rosewood	92	35	61.7	1.30	
San Jacinto	96	39	64.6	1.76	
Sierra Madre	88	45	65.9	3.28	
Florida.					
Bartow	88	50	73.0	1.38	
Illinois.					
Aurora	78	24	48.6	0.22	
Indian Territory.					
Wagoner				6.68	
Iowa.					
Maple Valley				2.34	
Kansas.					
Delphos *‡	85	31	52.8	2.56	
Dresden *§	88	22	56.3	1.55	5.0
Girard *‡	88	38	56.0	2.36	
Goodland	89	25	55.2		
Lyons				3.17	
Norton				2.00	
Pratt	90	29	55.6	1.90	T.
Yates Center	87	31	55.2	4.17	
Louisiana.					
Lake Providence				3.19	
Ruston	90[h]	45[h]	65.0[n]	6.50	
Maryland.					
McDonogh	72	34	53.0		
Massachusetts.					
Ashland				3.69	
Fiskdale				3.39	
Hyde Park *§		28	48.1		
Waltham				3.23	
Michigan.					
Baldwin	70	15	43.2	1.00	3.0
Benzonia	75	28	47.4	1.33	2.5
Carsonville	71	21	45.1	0.53	
Manistee	70	21	43.4		
Two Heart River *[10]	62	22	41.1		
Mississippi.					
Corinth	85	38	62.0	0.91	
Greenville *b*	80	37	63.3		
Mosspoint	80	48	66.4	8.45	
Missouri.					
Akron				2.54	
Appleton City	84	30	55.0	2.30	
Mansfield				3.30	
Richmond	84	28	55.2	1.69	
Steffenville				2.47	
Montana.					
Harlem	75	12	50.0	0.04	
Troy		23		0.98	
Nebraska.					
Indianola *‡	78[m]	21[m]	47.5[m]	1.87	6.0
Stockham				2.50	2.0
Wisner				2.62	
Nevada.					
Empire Ranch	83	14	46.2	0.02	
St. Thomas	94	39	65.2	0.92	
New Mexico.					
Eddy	90	42	62.9	2.92	
Fort Union				3.52	
New York.					
Bolivar	73	19	44.0	4.03	T.
Mount Morris	85	30	55.5	1.41	
Rose				1.76	
North Carolina.					
Mocksville	79	30	59.2	0.74	
Southern Pines *b*	81	37	59.4	1.91	
Ohio.					
Vanceburg	79	29	52.2	1.95	
Oregon.					
Cascade Locks	78	40	56.3	3.85	
Glenora	79	31	51.6	8.46	
Joseph	74	25	45.2	1.25	2.0
Tillamook Rock L. H.				4.25	
Rhode Island.					
Providence *a*	75	32	49.8	2.71	
Tennessee.					
Byrdstown*	79	32	55.0	0.85	
Texas.					
Graham				11.90	
Rock Springs				6.32	
Washington.					
Olga	66	39	50.1	3.32	
Wisconsin.					
Bayfield	72	23	44.2	3.64	T.
Centralia	76	15	44.7	1.78	1.0
City Point	72			3.16	T.
Prairie du Chien	78			2.49	T.
Shawano	72	15	42.8	2.57	1.0
Wyoming.					
Bighorn Ranch	75	10	41.2	0.40	5.0
Mexico.					
Mexico	75	49	62.7	3.74	

EXPLANATION OF SIGNS.

* Extremes of temperature from observed readings of dry thermometer.

† Weather Bureau instruments.

‡ Record furnished by the Arrowhead Reservoir Company, in the San Bernardino Mountains, San Bernardino County, Cal., at elevations varying from 4,900 to 6,900 feet.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.
[7] Mean from hourly readings of thermograph.
[8] Mean of 7 a. m. + 2 p. m. + 9 p. m. ÷ 3.
[9] Mean of sunrise and noon.
[10] Mean of sunrise, noon, sunset, and midnight.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "*a*" denotes 14 days missing.

CORRECTIONS.

Nebraska, Fremont, September, 1896, make precipitation read 5.48 instead of 5.03.

Arkansas, Arkansas City, October, 1896, make precipitation read 3.50 instead of 2.80.

Massachusetts, South Clinton, October, 1896, make precipitation read 3.95 instead of 3.93.

Washington, Cascade Tunnel, October, 1896, make precipitation read 2.87 instead of 2.37.

TABLE III.—*Data from Canadian stations for the month of November, 1896.*

Stations.	Pressure.			Temperature.		Precipitation.		Prevailing direction of wind.	Total depth of snow.
	Mean not reduced.	Mean reduced.	Departure from normal.	Mean.	Departure from normal.	Total.	Departure from normal.		
	Inches.	*Inches.*	*Inches.*	°	°	*Inches*	*Inches.*		
St. Johns, N. F	29.88	30.03	+ .10	34.8	— 2.2	4.99	.....	ne.	T.
Sydney, C. B. I	30.05	30.11	+ .15	37.6	+ 0.1	3.42	— 2.19	nw.	5.5
Grindstone, G. St. L.	30.00	30.03	.....	33.6	.....	5.17	.....	nw.	15.6
Halifax, N. S	30.06	30.19	+ .19	39.5	+ 1.5	4.39	— 0.83	nw.	9.6
Grand Manan, N. B.	30.10	30.15	.....	39.0	.....	3.84	— 0.59	w.	4.5
Yarmouth, N. S.	30.06	30.16	+ .12	41.2	+ 1.2	3.77	+ 0.83	se.	3.3
St. Andrews, N. B.	.....	.....	.....	36.4	.....	2.10	— 1.12	n.	3.0
Charlottet'n, P. E. I.	30.07	30.11	.....	35.8	.....	2.55	— 1.18	nw.	4.2
Chatham, N. B	30.10	30.12	+ .14	30.0	— 0.5	3.89	+ 0.47	w.	14.6
Father Point, Que.	30.06	30.09	+ .13	27.3	— 1.7	4.24	+ 1.78	w.	7.2
Quebec, Que	29.77	30.11	+ .10	29.2	+ 0.2	6.37	+ 2.35	w.	11.2
Montreal, Que	29.90	30.12	+ .10	33.8	+ 1.3	4.20	+ 1.06	sw.	5.9
Rockliffe, Ont	29.55	30.08	+ .08	30.3	+ 1.3	3.85	+ 1.20	se.	28.8
Kingston, Ont	29.79	30.11	+ .07	38.8	+ 3.3	3.04	— 0.38	w.	....
Toronto, Ont	29.72	30.11	+ .06	38.9	+ 2.4	2.94	— 0.01	sw.	3.5
White River, Ont	28.65	30.08	.....	15.5	— 5.0	3.06	+ 1.17	ne.	27.1
Port Stanley, Ont	29.48	30.13	+ .08	39.0	.....	3.00	— 0.15	w.	T.
Saugeen, Ont	29.34	30.07	+ .06	37.6	+ 2.1	3.34	— 0.56	w.	10.2
Parry Sound, Ont.	29.34	30.06	+ .04	35.2	+ 3.2	5.79	+ 1.58	w.	21.2
Port Arthur, Ont	29.32	30.06	+ .05	17.8	— 6.7	2.62	+ 0.64	nw.	13.4
Winnipeg, Man	29.26	30.16	+ .09	6.7	—11.3	1.31	+ 0.32	n.	13.1
Minnedosa, Man	28.25	30.20	+ .16	5.6	—10.9	1.88	+ 1.08	nw.	18.8
Qu'Appelle, Assin.	27.80	30.26	+ .23	— 0.4	—19.9	1.77	+ 1.17	nw.	17.7
Medicine Hat, Assin	27.78	30.20	+ .16	1.0	—26.0	2.12	+ 1.79	w.	21.2
Swift Curr't, Assin.	27.48	30.28	+ .22	2.0	—20.0	1.38	+ 0.87	w.	11.2
Calgary, Alberta	26.44	30.26	+ .22	1.4	—24.6	2.26	+ 1.91	w.	22.6
Prince Albert, Sask.	28.54	30.19	.....	0.3	.....	1.44	.....	sw.	14.4
Edmonton, Alberta.	27.80	30.26	+ .38	— 1.6	—28.6	2.59	+ 2.37	nw.	25.9
Battleford, Sask	28.44	30.35	... .	— 3.4	.....	1.37	.....	w.	13.7
Kamloops, B. C.*	28.89	30.21	... .	15.6	.....	2.52	.....	w.	23.3
Hamilton, Bermuda	30.10	30.26	+ .21	68.2	... .	3.38	.....	ne.	0.0
Banff, Alberta	25.28	30.29	.....	— 0.8	.....	4.88	.....	ne.	48.6
Esquimalt, B. C.	29.94	29.97	.....	36.4	.. ....	10.97	....	n.	5.5
Ottawa, Ont	29.77	30.14	.....	33.0	.....	2.32	.....	s.	5.3

* Kamloops, 85 miles east of Spences Bridge.

TABLE IV.—*Meteorological observations at Honolulu, Republic of Hawaii, by Curtis J. Lyons, Meteorologist to the Government Survey.*

Pressure is corrected for temperature and reduced to sea level, but the gravity correction, —0.06, is still to be applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 10. Two directions of wind, connected by a dash, indicate change from one to the other; also same for force.

The rainfall for twenty-four hours is given as measured at 6 a. m. on the respective dates.

November, 1896.	Pressure at sea level.			Temperature.					Relative humidity.			Wind.		Cloudiness.	Rain measured at 6 a. m.
	9 a. m.	3 p. m.	9 p. m.	6 a. m.	2 p. m.	9 p. m.	Maximum.	Minimum.	9 a.m.	2 p. m.	9 p. m.	Direction.	Force.		
	Ins.	*Ins.*	*Ins.*	°	°	°	°	°	%	%	%				*Ins.*
1	30.05	29.95	29.98	74	81	75	83	73	63	64	78	ene-se.	3-0	8	0.10
2	29.99	29.92	29.97	72	80	72	81	72	84	68	93	se.	1-2	8	0.12
3	29.99	29.93	29.96	74	82	75	84	72	77	74	86	sse.	3-0	8	0.10
4	30.03	29.94	30.00	75	80	74	83	74	83	75	90	se.	0-2	9	0.01
5	30.00	29.92	29.96	74	81	76	84	73	79	64	84	ese.	1-2	9-5	0.00
6	30.01	29.87	29.96	73	81	76	83	72	77	70	89	se.	3-4	7	0.04
7	30.00	29.93	30.01	75	80	76	82	75	87	77	86	s.	3-4	10	0.07
8	30.01	29.92	30.00	74	80	76	83	74	83	77	86	s.	4	9	0.06
9	29.98	29.90	29.98	75	80	77	82	74	79	81	83	s.	3	9	0.03
10	29.97	29.90	29.96	76	81	78	82	76	81	78	72	s-sw.	4-2	10-5	0.01
11	30.00	29.93	29.99	73	81	73	83	73	83	78	91	sw.	2	3	0.50
12	30.00	29.94	29.98	71	79	72	82	69	70	65	75	sw.	2-4	1	0.03
13	30.00	29.91	29.96	70	79	70	82	69	68	62	79	wsw.	1-4	2	0.00
14	30.00	29.92	30.00	69	79	69	81	68	63	58	76	sw.	3-0	2	0.00
15	30.03	29.95	30.02	67	78	71	81	67	60	66	70	sw-e-ne	1	2-8	0.00
16	30.05	29.99	30.06	68	78	71	83	66	69	65	68	s-sw.	1	2	0.00
17	30.09	30.02	30.07	65	79	70	81	65	61	51	88	n.	0-3	1-3	0.00
18	30.07	29.98	30.03	67	80	72	82	67	69	58	78	nne.	0-3	2-8	0.05
19	30.04	29.94	30.05	69	80	70	83	68	61	52	74	ne.	1-4	2	0.08
20	30.02	29.93	30.05	69	79	70	83	68	66	61	74	w-s-ne.	0-2	7	0.00
21	30.04	29.94	30.06	68	82	74	85	67	73	63	75	sw.	1	4	0.00
22	30.02	29.92	30.00	70	81	71	83	69	63	51	71	ne-e.	1	2-0	0.00
23	29.97	29.88	29.94	69	80	72	83	68	61	58	74	ne-se.	0-3	2	0.00
24	29.95	29.85	29.94	72	80	75	82	69	72	68	91	se.	1	7	0.00
25	29.99	29.93	30.04	75	79	73	80	74	89	75	95	sse-s.	3	9	0.36
26	30.08	30.00	30.05	72	79	74	82	71	84	81	91	ssw.	0-2	9	0.70
27	30.06	29.95	30.00	73	78	72	81	71	93	87	93	ssw.	0-3	8	0.04
28	30.01	29.92	30.00	71	74	71	78	71	95	91	89	sse.	0-2	9	0.81
29	30.05	29.99	30.07	70	77	71	80	68	77	71	86	sw.	0-2	5-10	0.34
30	30.08	29.98	30.06	68	78	71	80	68	80	65	79	ssw-nw	1	4	0.01
	30.02	29.94	30.00	71.3	79.6	72.9	82.1	70.4	74.7	66.8	82.0		1.8	5.8	3.46

Mean temperature: 6+2+9÷3 is 74.6; extreme temperatures, 85° and 65°.

The month was characterized by abnormally high temperature and unusual humidity accompanying prevailing southerly winds.

TABLE V.—*Mean temperature for each hour of seventy-fifth meridian time, November*, 1896.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Bismarck, N Dak.....	5.9	6.1	6.0	5.9	5.5	5.4	5.5	5.2	4.9	5.9	6.9	8.2	9.1	10.3	10.6	10.8	10.5	9.6	8.7	7.8	6.8	6.3	6.1	5.8	7.2
Boston, Mass.	44.5	44.1	44.1	44.1	44.1	43.8	44.0	44.5	45.5	46.8	48.2	49.2	49.8	50.3	50.2	49.7	48.7	47.8	47.0	46.1	45.3	44.8	44.3	43.9	46.3
Buffalo N Y.....	41.9	42.1	41.8	41.5	41.3	41.6	41.7	42.0	42.3	43.4	44.6	45.1	45.4	45.4	44.8	44.5	44.1	43.4	43.0	43.2	42.3	41.7	41.1	40.8	42.9
Chicago, Ill.....	38.1	37.4	37.0	36.7	36.2	35.7	35.5	35.6	35.5	36.2	37.2	38.6	40.0	40.2	40.3	40.5	40.4	40.1	39.8	39.4	38.9	38.5	38.0	37.9	38.1
Cincinnati, Ohio.....	46.4	45.7	45.1	44.8	44.3	44.0	43.7	43.7	44.1	45.4	47.4	49.2	50.6	51.6	52.1	52.0	51.9	51.0	50.0	49.2	48.0	47.2	46.6	45.8	47.5
Cleveland, Ohio	43.4	43.1	42.9	42.9	42.6	42.2	41.9	41.9	43.1	44.5	45.4	46.7	46.9	47.2	47.3	46.7	46.0	45.5	45.3	44.7	43.9	43.2	43.0	42.4	44.3
Detroit, Mich.....	39.4	39.2	39.2	39.3	39.3	39.0	39.0	39.2	39.7	40.8	41.9	42.4	42.6	43.5	43.5	43.5	42.4	41.5	41.2	40.8	39.6	39.1	38.8	38.5	40.6
Dodge City, Kans.....	34.4	33.5	32.8	31.4	30.3	29.6	28.6	28.3	28.3	31.1	35.9	39.5	42.5	44.7	46.1	47.1	47.3	46.3	42.4	39.1	37.1	36.0	35.1	34.6	36.8
Eastport, Me.....	37.9	37.6	37.3	37.1	36.5	36.5	36.3	36.6	37.3	38.3	39.3	39.6	40.0	40.2	40.2	40.0	39.7	39.2	38.8	38.7	38.2	38.0	37.8	37.5	38.3
Galveston, Tex.....	64.9	64.6	64.7	64.6	64.4	64.0	63.9	63.9	64.0	64.7	65.7	66.5	66.9	67.5	67.5	67.5	67.2	66.7	66.2	65.7	65.3	64.8	64.6	64.1	65.4
Havre, Mont.....	2.6	2.2	2.1	2.4	2.2	1.9	1.7	2.5	2.2	1.7	2.7	3.8	5.4	7.1	8.3	8.9	9.2	8.6	6.3	4.1	2.7	2.1	1.6	1.5	3.9
Kansas City, Mo.....	39.7	38.9	38.5	38.2	37.6	37.3	36.8	36.4	36.7	37.7	39.6	41.8	43.5	45.0	45.7	45.5	44.9	43.9	42.6	42.0	40.9	40.5	39.7	39.1	40.5
Key West, Fla.....	76.1	76.1	76.1	76.0	75.9	75.7	75.7	76.0	77.3	78.0	78.5	78.8	79.2	79.0	78.8	78.4	78.0	77.4	77.2	76.9	76.8	76.8	76.6	76.2	77.1
Memphis, Tenn.....	52.0	51.3	50.6	50.1	49.4	49.1	47.6	48.5	49.1	51.0	53.5	55.4	56.8	58.1	59.1	59.6	59.3	58.4	56.4	55.3	53.9	52.9	52.0	51.5	53.4
New Orleans, La.....	62.2	62.0	61.8	61.6	61.4	61.0	60.9	61.0	62.0	63.9	66.1	68.1	69.2	69.8	69.9	70.0	69.3	68.1	66.4	64.8	63.8	62.7	62.3	61.7	64.6
New York, N. Y.....	47.1	46.6	46.0	45.7	45.4	45.0	45.3	45.8	46.7	47.6	49.6	50.5	51.2	51.2	51.4	50.7	49.7	49.0	48.4	48.2	47.6	47.3	46.6	46.3	47.9
Philadelphia, Pa.....	48.5	48.3	47.9	47.8	47.2	46.9	47.0	47.5	49.1	50.9	52.6	54.3	55.3	55.5	55.7	55.3	54.1	52.7	51.6	50.9	49.7	48.9	48.5	48.1	50.6
Pittsburg, Pa.....	46.6	46.2	45.6	45.3	44.8	44.5	44.5	44.9	46.1	47.9	49.9	51.4	52.7	53.4	53.2	53.1	52.7	51.8	50.6	49.5	48.5	47.7	46.9	46.0	48.5
Portland, Oreg.....	38.0	37.9	37.8	37.5	37.5	37.1	36.8	37.0	36.4	36.2	36.3	36.9	37.8	38.4	38.6	39.2	39.7	39.8	39.5	39.2	38.7	38.2	37.8	37.7	37.9
St. Louis, Mo.....	43.8	43.3	42.9	42.5	42.2	41.8	41.6	41.5	41.9	43.3	45.3	47.0	48.2	49.5	50.2	50.7	50.3	49.3	48.3	47.2	46.3	45.4	44.3	43.4	45.4
St. Paul, Minn.....	21.4	20.9	20.7	20.3	19.9	19.3	18.9	19.0	19.1	19.5	20.6	22.0	23.6	24.4	24.9	25.1	24.8	24.5	23.8	23.2	22.3	21.7	21.0	20.7	21.7
Salt Lake City, Utah..	35.3	35.5	35.0	34.5	34.6	34.8	34.2	33.8	33.0	32.9	34.3	36.6	34.0	41.4	42.4	42.8	42.8	42.3	40.5	38.6	37.6	36.4	35.7	35.4	37.0
San Diego, Cal.....	56.8	56.4	55.5	55.4	55.1	54.6	54.2	53.7	53.4	53.8	57.6	60.6	63.2	64.6	65.9	65.9	65.7	65.2	63.6	62.3	60.9	59.6	58.2	57.2	59.1
San Francisco, Cal....	52.2	51.7	51.4	51.2	50.8	50.5	50.2	50.2	49.6	49.3	50.0	51.4	52.5	53.9	55.6	56.6	57.2	57.0	55.9	54.8	53.6	53.1	52.9	52.4	52.7
Savannah, Ga.....	60.3	59.1	58.6	57.5	56.8	56.3	56.2	57.2	59.7	63.6	66.4	68.3	69.4	70.3	70.3	69.5	67.5	65.3	63.9	62.9	62.3	61.4	60.5	59.9	62.6
Washington, D. C....	47.7	46.9	46.3	45.7	45.5	45.0	44.4	45.7	48.3	50.9	53.6	55.6	57.3	57.9	58.4	57.7	56.3	54.3	52.8	51.8	50.5	49.8	48.8	47.9	50.8

TABLE VI.—*Mean pressure for each hour of seventy-fifth meridian time, November*, 1896.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Bismarck, N. Dak...	28.345	.345	.344	.347	.341	.336	.336	.330	.335	.342	.343	.342	.336	.322	.310	.305	.313	.324	.332	.335	.345	.356	.361	.364	.337
Boston, Mass.....	30.028	.033	.030	.033	.033	.041	.050	.057	.060	.061	.043	.028	.014	.005	.007	.009	.019	.023	.029	.035	.041	.039	.042	.042	.033
Buffalo, N. Y.....	29.276	.277	.277	.274	.279	.278	.282	.289	.297	.299	.299	.287	.274	.266	.264	.270	.276	.285	.287	.290	.290	.290	.288	.292	.283
Chicago, Ill.....	29.197	.196	.207	.208	.207	.213	.215	.227	.233	.238	.242	.231	.209	.198	.194	.193	.196	.201	.206	.211	.213	.214	.215	.218	.212
Cincinnati, Ohio ...	29.512	.512	.519	.520	.524	.529	.536	.547	.563	.568	.567	.555	.535	.519	.507	.504	.508	.513	.518	.521	.529	.532	.532	.532	.529
Cleveland, Ohio	29.295	.295	.297	.299	.302	.304	.309	.312	.326	.326	.327	.315	.304	.299	.294	.293	.298	.304	.306	.309	.309	.310	.311	.312	.307
Detroit, Mich.....	29.311	.310	.312	.309	.310	.310	.317	.332	.335	.337	.338	.331	.320	.311	.306	.309	.313	.319	.322	.325	.330	.329	.330	.330	.321
Dodge City, Kans..	27.440	.442	.438	.443	.445	.449	.458	.460	.470	.476	.477	.478	.465	.442	.427	.416	.410	.413	.420	.433	.444	.446	.451	.451	.446
Eastport, Me.....	30.046	.051	.050	.052	.057	.062	.074	.083	.089	.088	.073	.060	.051	.048	.053	.054	.061	.061	.066	.065	.066	.062	.057	.055	.062
Galveston, Tex.....	30.089	.085	.081	.078	.074	.078	.084	.091	.097	.113	.124	.122	.104	.079	.061	.056	.055	.059	.072	.082	.090	.100	.104	.106	.086
Havre, Mont.....	27.428	.427	.419	.421	.423	.421	.422	.423	.442	.447	.451	.454	.454	.448	.442	.439	.437	.439	.440	.447	.450	.454	.452	.453	.439
Kansas City, Mo....	29.100	.098	.097	.098	.094	.096	.097	.099	.115	.122	.131	.133	.117	.098	.084	.082	.086	.091	.100	.108	.117	.119	.119	.119	.105
Key West, Fla.....	30.062	.055	.046	.045	.043	.047	.059	.074	.087	.093	.091	.078	.055	.034	.027	.026	.029	.042	.057	.073	.079	.080	.076	.069	.059
Memphis, Tenn.....	29.749	.750	.754	.758	.756	.763	.772	.782	.796	.808	.811	.802	.785	.764	.743	.734	.732	.733	.736	.746	.753	.757	.762	.767	.763
New Orleans, La....	30.091	.085	.082	.081	.081	.083	.090	.096	.109	.120	.125	.118	.099	.077	.061	.059	.060	.066	.075	.088	.097	.104	.104	.102	.090
New York, N. Y....	29.842	.846	.848	.848	.852	.855	.863	.871	.877	.875	.861	.848	.834	.826	.827	.831	.839	.846	.855	.858	.862	.863	.863	.861	.852
Philadelphia, Pa....	30.082	.084	.083	.086	.089	.094	.105	.112	.116	.113	.100	.086	.071	.063	.062	.066	.071	.079	.086	.092	.098	.098	.100	.098	.089
Pittsburg, Pa.....	29.265	.266	.269	.272	.278	.284	.294	.297	.301	.304	.303	.292	.278	.269	.267	.268	.269	.275	.278	.280	.280	.282	.280	.279	.280
Portland, Oreg.....	29.864	.864	.866	.868	.871	.873	.873	.875	.874	.880	.889	.894	.895	.892	.880	.871	.860	.858	.855	.853	.853	.855	.856	.858	.870
St. Louis, Mo.....	29.550	.550	.555	.556	.555	.559	.564	.572	.578	.580	.583	.575	.556	.537	.527	.525	.527	.530	.541	.547	.553	.558	.567	.570	.555
St. Paul, Minn.....	29.157	.160	.163	.163	.162	.164	.166	.164	.168	.171	.171	.171	.155	.140	.127	.128	.134	.143	.151	.157	.161	.168	.173	.178	.158
Salt Lake City, Utah	25.658	.657	.657	.655	.657	.655	.662	.663	.672	.682	.688	.688	.688	.673	.655	.648	.648	.653	.658	.661	.661	.667	.667	.668	.664
San Diego, Cal.....	29.978	.978	.975	.971	.966	.964	.962	.962	.969	.976	.994	.003	.014	.010	.993	.974	.960	.957	.958	.961	.966	.975	.982	.987	.976
San Francisco Cal..	29.949	.952	.951	.947	.947	.943	.940	.940	.945	.956	.967	.974	.980	.973	.956	.941	.931	.926	.927	.926	.936	.941	.943	.949	.948
Savannah, Ga.....	30.112	.113	.112	.113	.117	.122	.133	.146	.156	.162	.160	.148	.125	.105	.092	.088	.089	.091	.099	.108	.117	.121	.122	.122	.120
Washington, D. C...	30.096	.098	.098	.102	.106	.110	.120	.129	.137	.141	.137	.116	.101	.088	.084	.087	.090	.097	.102	.111	.116	.117	.116	.115	.109

TABLE VII.—*Average wind movement for each hour of seventy-fifth meridian time, November, 1896.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Abilene, Tex.	11.7	11.5	12.0	12.5	13.1	12.2	11.8	11.7	11.8	12.9	13.8	13.9	14.3	14.5	14.5	14.0	13.6	12.9	10.6	8.5	8.8	9.6	11.3	11.4	12.2
Albany, N. Y.	7.0	7.3	7.3	7.7	7.9	8.9	8.3	8.1	8.3	9.6	10.2	10.7	11.1	11.1	10.7	10.2	9.2	8.2	7.5	7.9	6.9	7.2	7.1	7.4	8.6
Alpena, Mich.	10.5	10.2	9.6	9.9	10.6	10.5	10.5	10.9	11.3	11.8	12.4	13.0	13.3	13.1	13.0	12.7	12.9	11.9	11.8	11.3	11.9	11.5	12.0	11.3	11.6
Amarillo, Tex.	16.4	16.5	16.4	16.1	16.2	15.3	15.1	14.8	14.6	14.5	15.9	16.1	16.4	16.7	17.0	18.0	18.7	18.3	15.7	15.1	14.9	16.1	16.8	17.2	16.2
Atlanta, Ga.	9.2	9.9	9.9	9.5	9.0	8.9	8.7	9.3	9.6	9.6	9.9	9.5	9.8	9.9	9.7	9.4	9.1	8.0	7.9	8.9	8.8	9.6	9.9	9.9	9.3
Augusta, Ga.	3.7	3.6	3.8	3.8	3.8	3.7	4.2	4.3	4.7	5.2	5.9	6.5	7.6	7.3	7.3	7.4	6.9	5.4	4.6	4.4	4.6	4.3	4.1	4.3	5.1
Baker City, Oreg.	8.1	8.0	7.4	7.4	8.2	7.6	7.1	8.1	8.2	7.1	7.5	7.4	7.5	8.0	8.7	8.3	8.9	8.8	7.8	6.9	6.4	6.4	7.3	7.5	7.7
Baltimore, Md.	3.4	3.0	3.3	3.0	3.2	3.4	3.5	3.6	4.3	5.1	5.2	5.7	6.2	6.3	6.4	5.7	5.2	4.5	4.2	4.2	3.4	3.7	3.5	3.5	4.4
Bismarck, N. Dak.	9.7	9.8	9.8	9.8	10.1	9.8	9.1	9.6	9.5	9.6	10.3	11.4	12.0	12.0	12.2	12.7	12.0	11.3	10.1	10.3	9.9	8.7	9.5	9.7	10.4
Block Island, R. I.	15.4	15.5	16.4	16.4	16.8	17.1	16.9	16.3	16.2	16.7	16.1	16.3	16.3	16.1	16.1	15.7	15.9	15.2	14.9	14.4	14.4	14.1	14.9	15.7	15.8
Boston, Mass.	10.6	10.3	10.1	10.1	10.1	10.4	10.6	11.4	11.6	11.9	12.8	12.8	12.6	12.6	12.4	11.9	11.0	10.3	10.2	10.6	10.0	10.3	10.4	10.5	11.1
Buffalo, N. Y.	18.5	19.1	19.2	18.6	17.7	18.1	18.0	18.7	19.0	18.5	18.1	18.0	18.8	19.8	19.6	19.7	20.4	20.5	19.5	20.1	19.7	20.5	20.1	18.2	19.1
Cairo, Ill.	11.7	11.6	10.8	10.7	10.2	10.1	9.9	9.7	10.5	11.9	12.9	12.6	13.3	12.7	12.7	13.0	13.3	12.0	11.5	11.3	11.2	11.2	11.3	11.8	11.6
Cape Henry, Va.	13.6	14.1	14.5	14.8	14.5	13.6	13.6	14.3	14.1	15.0	14.7	14.5	14.0	13.5	13.8	13.3	12.6	12.5	12.9	13.1	14.0	14.4	15.2	14.7	14.0
Charleston, S. C.	6.9	7.1	6.4	7.2	7.1	6.9	7.1	7.3	6.9	7.4	8.0	7.5	8.2	9.0	9.2	9.1	8.5	6.8	6.8	6.7	6.6	6.5	6.4	6.8	7.4
Charlotte, N. C.	6.7	7.0	6.4	6.6	6.3	6.3	5.8	6.2	6.0	6.7	7.2	8.1	8.5	8.3	8.5	8.4	7.4	6.0	5.8	6.8	6.8	6.7	6.9	6.7	6.9
Chattanooga, Tenn.	5.7	6.0	5.2	4.8	5.1	5.4	5.8	5.4	5.4	6.9	7.9	8.2	9.0	9.0	9.7	10.0	9.3	7.7	7.2	5.9	5.6	5.8	6.0	6.4	6.8
Cheyenne, Wyo.	12.6	11.4	11.4	10.3	8.9	8.9	9.1	9.6	9.3	9.0	11.0	14.8	17.9	18.7	19.6	19.7	18.5	17.9	14.1	13.3	13.2	12.6	11.8	12.8	13.2
Chicago, Ill.	19.7	19.2	18.7	19.2	19.1	19.0	18.7	18.3	18.1	18.6	19.0	19.3	20.8	21.1	21.3	21.0	20.3	19.8	20.3	19.8	19.7	19.1	19.3	19.0	19.5
Cincinnati, Ohio.	7.6	7.1	7.3	6.8	7.0	6.4	6.7	7.1	7.9	8.8	9.2	10.2	10.1	10.2	10.2	10.3	9.6	8.6	8.4	9.0	8.9	8.3	8.2	7.7	8.4
Cleveland, Ohio.	18.1	18.0	18.0	18.2	18.1	18.1	18.4	18.5	17.9	17.5	17.2	18.1	19.1	18.9	18.0	17.4	17.3	16.4	17.3	18.5	19.2	19.1	18.6	18.9	18.1
Columbia, Mo.	9.6	9.3	10.0	10.1	9.8	9.9	9.8	10.3	10.7	11.6	12.2	12.5	13.1	13.6	14.2	13.2	12.3	10.9	9.6	10.2	10.6	10.6	10.8	10.5	11.1
Columbus, Ohio.	7.8	7.9	8.0	8.2	7.7	7.5	7.1	7.7	7.9	8.6	9.5	9.9	10.2	10.9	10.7	10.3	9.3	8.8	8.5	9.0	8.8	8.8	8.6	8.5	8.8
Concordia, Kans.	6.6	6.9	7.2	7.8	7.9	7.2	6.1	6.4	6.8	7.7	9.3	9.7	10.0	10.0	9.9	9.9	9.1	8.0	6.2	6.0	5.9	6.2	6.6	6.5	7.7
Corpus Christi, Tex.	11.0	9.8	9.6	9.9	10.0	10.2	10.3	10.0	9.7	10.0	11.5	12.4	13.5	14.0	14.0	14.2	14.0	13.7	13.1	12.3	12.4	12.2	11.7	10.8	11.7
Davenport, Iowa.	8.8	8.6	8.7	8.2	7.9	8.1	8.3	8.2	9.0	9.3	10.1	10.8	11.6	11.5	12.0	11.1	10.8	9.7	8.7	9.0	8.6	8.3	8.2	8.4	9.3
Denver, Colo.	6.7	7.0	6.5	7.1	6.2	6.1	5.7	6.2	6.7	6.0	5.4	5.7	7.3	8.4	9.7	10.9	12.4	11.6	10.4	9.2	8.1	8.1	8.1	7.8	7.8
Des Moines, Iowa.	7.4	7.3	7.2	7.9	7.8	8.5	8.7	8.8	9.0	9.7	10.0	10.2	10.7	10.2	10.9	11.1	10.6	9.8	9.0	8.8	8.3	8.1	8.0	7.8	9.0
Detroit, Mich.	11.7	12.0	11.5	11.4	11.8	11.8	11.0	11.2	12.0	13.2	14.0	14.9	14.6	14.7	14.6	14.6	14.1	13.2	13.0	12.4	12.7	12.8	12.7	12.3	12.8
Dodge City, Kans.	10.0	9.5	9.3	8.9	9.4	9.4	8.9	8.3	8.9	10.2	11.4	12.2	12.3	12.7	13.0	13.7	13.5	11.7	8.4	7.8	8.9	9.1	9.5	9.6	10.3
Dubuque, Iowa.	5.2	5.0	5.1	5.0	5.1	4.8	4.9	4.8	5.4	5.7	6.1	6.5	6.7	6.7	7.0	6.7	5.9	5.5	5.3	5.4	5.1	5.0	5.3	5.1	5.6
Duluth, Minn.	9.5	9.4	9.6	10.0	10.5	10.3	9.8	10.3	11.1	11.7	11.7	12.4	12.0	12.0	12.3	12.2	12.0	10.8	10.3	10.4	9.8	10.5	9.9	10.0	10.7
Eastport, Me.	12.0	11.6	11.1	10.9	11.1	11.4	12.1	12.2	12.3	12.6	12.5	12.4	12.2	11.8	11.3	11.6	11.7	12.9	12.6	13.1	12.2	12.1	12.5	12.5	12.0
El Paso, Tex.	11.1	11.0	10.3	10.1	9.8	9.7	10.5	10.2	9.7	9.4	9.9	10.5	10.9	12.8	14.2	14.7	14.9	14.3	12.9	10.8	10.2	8.2	9.5	10.4	11.1
Erie, Pa.	15.0	14.5	14.1	15.2	14.8	14.7	14.6	14.4	13.9	14.0	13.7	13.8	14.6	14.4	14.0	14.0	12.8	13.1	13.9	14.0	14.4	15.3	15.5	15.3	14.3
Eureka, Cal.	5.6	5.2	5.1	5.0	4.2	4.2	4.1	4.4	4.3	4.5	4.2	5.2	5.6	6.4	8.4	9.3	9.7	10.2	10.6	9.4	7.9	7.2	6.3	5.7	6.4
Fort Canby, Wash.	20.6	19.4	18.6	18.2	18.0	17.8	17.5	18.4	16.8	17.6	17.9	18.1	18.9	19.9	20.7	21.8	21.1	20.6	20.7	19.8	19.8	20.4	21.3	20.9	19.4
Fort Smith, Ark.	7.3	7.4	7.7	8.1	8.7	8.0	7.1	7.2	7.0	7.8	8.1	8.7	9.3	9.8	10.4	10.8	10.4	9.1	7.4	7.4	7.7	7.5	7.1	7.0	8.2
Fresno, Cal.	4.4	4.6	4.6	4.4	4.2	4.2	4.0	4.1	4.0	3.7	4.0	3.8	4.5	4.6	4.9	5.1	5.1	4.7	4.0	3.2	3.0	3.4	3.8	4.1	4.2
Galveston, Tex.	13.2	13.0	12.9	12.7	13.2	12.9	12.8	12.9	13.2	12.6	12.7	12.4	13.5	14.2	13.9	13.0	13.5	12.9	12.9	13.3	13.7	14.2	13.9	13.9	13.2
Grand Haven, Mich.	14.2	14.5	14.1	13.9	13.6	13.6	12.9	12.9	12.8	13.2	13.7	14.2	13.9	14.4	14.5	14.4	14.0	13.4	13.6	14.0	14.3	13.6	14.2	14.4	13.8
Greenbay, Wis.	8.8	9.0	9.0	9.8	9.7	9.0	8.5	8.6	9.3	9.7	10.4	10.4	10.7	10.7	10.7	10.4	10.3	9.2	9.2	9.0	9.0	8.7	9.2	9.1	9.5
Hannibal, Mo.	10.8	10.6	11.0	11.6	11.6	11.3	11.9	11.7	11.3	12.4	13.2	13.2	14.2	14.3	14.6	13.8	12.2	10.3	9.7	9.3	9.3	10.1	10.4	11.1	10.6
Harrisburg, Pa.	5.8	6.2	6.6	7.1	6.5	6.3	6.8	6.9	7.5	8.2	8.4	8.6	8.6	9.4	8.9	8.3	7.7	7.4	7.1	7.3	7.1	6.7	6.7	6.0	6.1
Hatteras, N. C.	11.0	10.8	11.7	12.1	12.1	12.1	12.8	13.0	12.7	12.6	13.1	12.6	12.4	12.5	13.0	12.6	12.0	12.3	12.3	12.2	12.5	12.7	12.4	12.3	12.3
Havre, Mont.	6.5	6.5	6.7	7.1	7.5	7.1	6.8	7.0	7.0	7.0	7.2	7.8	7.3	7.7	7.7	7.3	6.9	7.3	6.6	6.0	5.7	6.2	6.6	7.0	6.9
Helena, Mont.	7.0	7.8	7.3	6.2	6.5	6.9	6.6	6.7	6.4	5.7	5.7	5.7	7.0	7.2	8.0	7.8	8.0	7.6	6.7	6.2	6.1	5.8	6.3	6.8	6.8
Huron, S. Dak.	12.2	13.0	12.8	12.4	13.0	13.3	13.2	13.5	13.6	13.8	13.8	13.9	14.1	14.5	14.3	14.3	13.4	13.1	12.9	13.2	13.2	12.8	12.6	12.6	13.3
Idaho Falls, Idaho.	9.3	8.9	8.5	8.7	7.8	8.3	8.6	8.5	7.8	7.9	9.5	10.1	10.5	10.9	11.7	12.5	11.9	11.4	11.0	11.0	11.0	10.2	10.9	10.0	9.8
Indianapolis, Ind.	12.1	11.9	11.7	11.6	11.3	11.9	11.4	11.6	12.4	12.7	13.4	13.9	15.3	15.0	15.3	15.2	14.6	12.5	12.5	13.0	12.8	11.8	11.5	12.9	12.9
Jacksonville, Fla.	5.5	5.8	5.8	5.9	5.7	5.6	5.3	5.8	5.7	6.8	8.8	10.2	9.7	9.9	9.5	9.4	9.1	7.7	6.9	7.1	6.4	6.1	6.1	6.0	7.1
Jupiter, Fla.	13.9	13.8	13.4	13.2	12.7	12.7	12.6	12.8	13.3	14.6	14.0	13.2	12.4	12.2	12.2	12.3	12.3	12.8	13.4	13.3	13.2	13.0	12.7	13.5	13.5
Kansas City, Mo.	10.8	11.1	11.3	10.8	10.7	10.3	10.6	10.5	10.9	11.8	12.1	12.2	12.4	12.2	12.3	11.7	10.5	9.4	9.4	9.5	9.1	9.4	10.7	10.7	11.0
Keokuk, Iowa.	9.5	9.5	9.0	8.6	8.4	8.5	8.7	9.2	10.0	10.5	10.9	11.0	11.1	11.3	11.0	10.1	9.3	9.2	9.5	9.1	9.4	9.7	9.3	10.6	9.6
Key West, Fla.	12.1	12.3	12.5	12.2	12.2	12.1	12.1	12.3	12.4	13.3	13.9	14.0	14.2	14.3	14.9	14.3	14.0	12.8	12.6	13.3	13.1	13.1	12.8	13.1	13.1
Kittyhawk, N. C.																									
Knoxville, Tenn.	3.0	3.1	3.2	3.3	3.4	3.6	3.5	3.9	4.2	4.7	5.0	4.8	5.7	6.1	6.2	5.9	5.4	4.3	4.1	3.4	3.2	3.4	2.9	3.2	4.1
La Crosse, Wis.	7.5	7.5	7.4	7.4	7.0	7.1	7.5	7.2	6.9	7.7	7.6	7.9	8.3	8.8	9.0	9.3	8.9	8.4	8.6	8.0	8.2	8.3	7.7	7.5	7.9
Lander, Wyo.	4.1	3.7	3.5	3.5	3.3	2.9	3.0	3.6	3.2	3.2	3.9	3.8	4.4	5.1	5.6	6.6	6.6	6.0	7.1	5.6	5.3	4.8	4.7	5.2	4.5
Lexington, Ky.	14.4	14.4	13.8	13.3	13.3	13.2	13.2	13.2	13.1	13.6	15.0	16.4	16.5	16.4	15.9	14.7	13.0	12.2	12.5	13.9	14.1	14.4	14.8	14.2	14.1
Little Rock, Ark.	6.8	6.8	7.2	7.0	7.2	7.1	7.0	7.6	7.9	8.9	10.1	10.2	11.6	11.3	10.8	10.5	10.4	9.7	8.3	7.4	7.2	7.2	7.2	6.9	8.4
Los Angeles, Cal.	2.9	2.9	2.6	2.6	2.6	3.2	3.2	3.7	4.0	3.7	3.7	4.5	5.0	5.0	5.0	5.2	5.5	6.1	6.0	5.1	3.5	2.5	2.6	2.7	3.9
Louisville, Ky.	7.8	8.0	7.8	7.6	7.4	6.6	6.6	7.2	7.3	8.1	8.6	9.2	9.3	9.8	10.0	9.7	9.2	7.8	7.7	7.9	8.1	8.0	8.1	8.4	8.2
Lynchburg, Va.	2.8	3.3	3.1	2.9	2.9	2.2	2.8	3.6	4.4	4.9	5.6	6.2	6.1	6.0	5.9	5.0	3.7	3.7	3.1	2.9	2.8	2.9	3.0	3.9	3.9
Marquette, Mich.	11.6	10.7	10.5	11.1	10.8	10.4	9.9	10.5	10.4	10.5	11.4	11.7	12.6	12.4	11.9	12.0	11.0	11.1	10.7	11.5	12.3	13.0	12.5	12.0	11.4
Memphis, Tenn.	11.3	11.3	10.3	11.0	10.5	10.5	10.4	11.1	11.9	11.8	12.1	12.2	12.8	13.0	11.9	12.1	11.6	10.5	10.4	11.4	11.6	12.3	12.5	12.0	11.5
Miles City, Mont.	7.1	7.0	6.7	6.0	6.2	5.7	5.9	6.6	6.8	7.2	7.3	7.6	8.0	8.1	8.3	7.8	7.8	7.4	7.7	7.9	8.0	8.1	8.4	8.2	7.9
Milwaukee, Wis.	12.4	12.1	12.0	12.8	10.8	10.6	11.3	11.2	10.9	12.2	12.6	12.6	13.6	14.2	14.3	13.6	13.3	12.0	11.4	11.5	12.3	12.0	11.5	12.0	12.2
Mobile, Ala.	7.1	6.8	6.6	7.2	7.3	6.8	7.1	7.1	7.2	8.2	8.4	9.3	9.8	9.6	9.6	9.2	9.2	9.0	7.5	7.2	7.8	7.5	6.9	6.7	7.9
Montgomery, Ala.	5.2	5.3	4.8	4.9	5.0	5.3	5.0	5.6	6.0	6.7	7.8	8.4	8.4	8.4	8.4	8.2	8.0	6.6	5.9	6.6	7.5	7.5	6.7	5.7	6.6
Moorhead, Minn.	8.6	9.4	9.5	9.5	9.7	9.2	9.8	10.0	9.8	9.7	10.5	11.3	11.0	11.8	11.7	11.5	10.5	9.8	9.8	9.5	9.6	9.8	9.1	8.9	10.0
Nantucket, Mass.	11.3	11.6	12.7	12.9	13.1	12.8	11.9	11.9	12.2	13.0	13.5	13.4	13.2	12.2	11.8	11.7	11.1	11.0	11.0	10.9	11.4	11.7	11.5	11.6	12.1
Nashville, Tenn.	7.4	7.7	7.1	7.1	7.2	7.3	7.3	7.0	7.1	7.9	10.1	10.8	12.1	12.3	11.8	11.3	10.6	9.1	8.3	8.4	7.6	7.3	8.1	7.7	8.7
New Haven, Conn.	7.5	7.3	7.9	7.4	7.6	7.3	8.6	9.4	9.6	10.8	11.4	12.2	13.0	12.9	12.4	11.8	10.0	9.0	8.8	9.0	8.9	8.5	8.2	8.0	9.5
New Orleans, La.	9.2	9.4	9.1	9.3	9.4	9.9	9.9	9.8	10.4	10.8	11.7	12.1	12.5	12.8	12.5	11.9	11.7	11.0	10.1	9.7	10.0	10.0	10.2	9.5	10.5
New York, N. Y.	14.6	13.7	12.7	12.8	13.0	13.1	13.5	13.9	15.2	15.2	15.5	15.6	16.4	16.3	15.8	15.8	15.0	14.8	14.7	14.1	14.0	13.9	13.5	13.8	14.5
Norfolk, Va.	8.3	8.0	8.2	8.3	8.4	8.3	8.5	8.1	8.5	8.9	10.0	10.0	9.8	10.3	9.9	9.8	8.2	9.0	8.1	8.7	8.7	8.0	8.7	8.8	8.8
Northfield, Vt.	10.7	10.6	10.3	9.7	10.6	10.0	9.4	9.9	10.5	10.9	12.5	13.9	14.2	12.6	12.7	10.9	10.2	9.7	8.8	8.5	8.7	8.1	10.1	10.8	
North Platte, Nebr.	7.6	7.2	6.8	7.1	7.4	7.8	8.2	8.3	8.4	8.3	9.6	10.3	10.7	11.7	12.4	12.7	11.8	10.4	8.8	8.6	8.4	8.2	8.0	9.1	
Oklahoma, Okla.	11.7	11.7	11.2	11.6	10.9	10.6	10.9	10.4	10.5	11.7	13.3	14.0	13.8	13.7	13.8	14.1	13.7	12.9	11.1	10.7	11.0	11.0	11.7	12.0	12.0
Omaha, Nebr.	6.4	6.7	7.2	7.1	7.3	6.8	6.4	7.2	7.5	7.4	7.6	8.4	9.0	9.5	9.5	8.9	8.8	8.0	6.9	6.8	6.7	6.6	6.1	6.2	7.5
Oswego, N. Y.	12.5	12.9	12.9	13.4	12.4	12.2	11.7	12.1	12.4	13.9	14.1	13.5	13.3	13.4	12.9	12.3	11.6	11.1	11.6	13.0	13.2	13.8	13.0	13.4	12.8
Palestine, Tex.	8.0	7.5	7.2	7.2	7.2	7.3	7.1	7.1	8.5	9.2	9.2	9.3	9.7	9.7	9.4	9.1	8.4	6.7	6.1	6.4	6.4	6.9	7.2	7.2	7.9
Parkersburg, W. Va.	5.8	6.1	6.1	5.6	5.5	5.5	5.6	6.0	5.9	7.7	8.1	8.8	8.8	8.3	7.2	6.5	5.7	6.0	5.9	5.6	5.8	5.6	6.1	6.2	6.5
Pensacola, Fla.	10.3	10.8	11.0	10.8	10.8	10.9	11.3	11.6	11.6	12.5	12.0	11.6	11.8	12.1	11.4	11.1	10.3	9.0	7.6	7.6	8.8	9.2	9.9	10.4	10.6

TABLE VII.—*Average wind movement, etc.*—Continued.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Philadelphia, Pa.....	8.9	9.4	8.9	8.1	8.5	8.6	8.8	9 6	9.7	10.8	11.4	11.5	11.9	12.3	12.0	11.2	10.5	9.5	9.3	9.5	9.2	8.9	9.1	9.0	9.9
Phœnix, Ariz	2.6	2.9	2.9	3.0	3.3	3.6	3.7	3.6	4.0	3.6	3.6	3.5	4.6	4.4	4.2	4.2	3.8	3.6	3.0	2.4	2.1	1.9	2.1	2.1	3.3
Pierre, S. Dak.....	9.7	9.9	9.1	9.0	9.3	8.2	9.0	9.5	9.1	9.1	9.8	9.7	10.2	11.2	11.3	11.3	10.8	10.4	10.0	9.7	9.8	10.1	9.6	9.4	9.8
Pittsburg, Pa.....	6.0	5.9	5.6	6.1	6.3	6.4	6.5	6.6	6.8	7.6	8.3	8.4	8.4	8.1	8.7	8.0	7.8	7.5	6.9	6.9	6.7	6.8	6.6	6.2	7.0
Port Angeles, Wash.*	6.4	6.7	6.6	6.2	6.0	6.8	5.8	6.2	6.2	5.9	6.0	5.7	5.4	5.7	6.1	5.7	5.8	6.7	5.8	5.8	5.6	5.6	6.1	7.0	6.2
Port Huron, Mich	12.4	12.7	12.4	13.0	13.0	12.6	12.2	12.0	12.9	14.8	16.0	15.9	16.0	15.4	15.7	14.9	14.2	13.2	13.2	13.4	13.6	13.6	13.3	12.6	13.7
Portland, Me	6.6	7.0	6.6	6.0	6.2	6.2	6.2	6.6	6.9	8.0	8.9	8.9	8.5	8.8	8.8	8.6	7.7	7.6	6.9	6.6	7.1	6.8	6.7	6.3	7.3
Portland, Oreg	13.0	13.3	13.5	14.3	13.4	13.0	12.6	11.2	10.5	10.7	10.4	11.2	12.1	12.2	12.9	12.8	13.2	12.7	12.1	10.8	11.1	10.6	12.6	13.0	12.2
Pueblo, Colo.....	6.3	6.8	5.8	5.4	4.6	6.0	5.1	5.9	5.9	5.6	6.1	7.0	8.1	8.5	9.2	10.1	9.6	9.9	8.5	7.3	8.4	7.6	7.1	7.0	7.2
Raleigh, N. C	5.4	5.5	5.6	5.2	5.0	5.2	4.8	5.3	6.4	6.9	7.1	8.0	7.9	7.8	7.9	7.8	6.6	5.1	5.3	5.1	5.9	5.6	5.5	5.8	6.1
Rapid City, S. Dak ...	9.6	9.2	7.9	7.8	8.5	8.2	8.2	8.8	9.2	8.7	8.7	8.6	9.1	8.9	9.9	9.5	10.0	9.5	8.6	7.8	7.3	7.6	9.8	10.1	8.8
Redbluff, Cal.....	7.2	7.7	6.9	6.8	6.5	6.4	6.5	6.9	6.9	7.1	6.8	7.2	7.6	8.5	8.7	9.0	8.6	8.1	7.5	7.2	7.1	6.8	6.3	6.9	7.3
Rochester, N. Y.....	8.1	7.8	8.0	8.2	8.4	7.9	8.2	8.0	8.4	9.5	9.9	10.3	10.2	10.0	10.3	9.4	8.9	8.8	9.0	8.5	8.0	8.2	8.6	8.4	8.8
Roseburg, Oreg.....	2.6	2.3	2.4	2.9	2.6	2.7	2.7	2.9	3.0	3.3	3.0	3.2	3.5	4.3	4.9	4.7	5.3	5.0	4.8	4.3	3.7	2.8	2.7	2.6	3.4
Sacramento, Cal.....	7.0	7.6	7.6	7.7	8.2	7.6	7.9	8.2	8.1	8.3	8.3	8.1	8.6	9.0	8.9	9.1	9.3	8.7	7.9	6.7	6.8	6.7	7.1	7.1	8.0
St. Louis, Mo	12.2	12.6	12.1	11.9	11.8	12.2	12.5	12.9	13.3	13.8	14.3	14.5	14.3	14.7	14.6	14.3	14.4	13.3	12.2	13.1	12.7	12.9	13.2	12.8	13.2
St. Paul, Minn.....	7.4	7.3	6.9	7.2	7.3	7.5	7.2	7.4	7.4	7.7	8.0	8.2	8.8	9.6	9.5	9.5	9.3	8.5	8.1	8.4	8.1	8.7	8.1	7.6	8.1
Salt Lake City, Utah.	5.4	4.8	4.9	5.1	5.2	5.3	6.0	5.7	5.1	4.8	5.0	4.7	6.6	7.8	9.2	9.8	9.3	7.3	5.2	4.1	4.2	4.2	4.2	4.6	5.8
San Antonio, Tex.....	8.3	7.6	7.8	7.6	7.5	7.5	7.5	7.4	7.9	8.9	10.4	11.5	12.6	12.0	11.4	11.1	10.4	9.3	8.5	8.3	8.4	9.2	9.3	9.3	9.2
San Diego, Cal.....	3.4	3.5	3.6	3.7	3.8	3.9	3.4	4.0	3.9	4.1	3.2	3.0	3.8	5.3	7.1	8.3	8.4	8.4	7.7	6.2	3.7	3.2	3.0	3.2	4.6
Sandusky, Ohio	10.4	9.9	9.9	9.8	9.8	9.7	9.4	9.5	9.6	10.4	11.1	12.1	11.7	11.4	11.5	11.1	9.9	9.6	9.8	10.3	10.7	11.4	11.6	11.2	10.5
San Francisco, Cal...	6.6	6.8	6.7	7.1	7.3	7.1	6.8	6.6	6.9	6.9	6.8	6.9	6.9	7.1	7.9	8.8	10.3	11.1	10.6	10.9	10.4	9.0	7.5	7.1	7.9
San Luis Obispo, Cal.	4.2	4.6	4.9	5.2	5.0	4.8	4.4	4.0	4.1	4.2	4.0	4.6	5.4	5.7	6.6	6.7	7.3	7.6	6.8	6.1	5.4	4.9	4.3	3.9	5.2
Santa Fe, N. Mex.....	5.1	5.4	5.2	5.9	5.8	4.9	5.3	5.4	5.5	5.0	6.7	7.4	8.9	9.7	9.8	10.3	9.5	9.3	7.7	5.6	4.9	5.0	5.1	5.4	6.6
Sault Ste Marie, Mich.	12.0	12.6	12.7	12.2	11.5	11.4	10.8	10.0	9.7	9.9	9.9	10.1	10.7	10.1	11.7	11.4	11.6	11.4	11.8	11.7	10.9	11.1	11.6	11.8	11.2
Savannah, Ga.....	5.9	5.8	6.3	6.6	7.0	6.8	6.6	7.1	7.0	7.1	8.5	8.7	9.4	9.7	9.9	9.7	8.7	7.4	6.7	7.1	6.8	6.5	6.4	6.9	7.4
Seattle, Wash	6.6	6.7	6.8	6.6	7.0	6.4	6.7	7.3	7.5	6.8	7.4	6.6	6.9	7.2	7.7	7.5	7.4	7.5	6.8	6.6	7.1	7.0	6.7	6.5	7.0
Shreveport, La	8.3	7.9	7.8	7.9	6.9	6.8	6.7	6.9	7.3	9.0	11.0	10.9	10.5	9.8	9.6	9.9	9.9	9.2	8.6	8.5	8.7	8.7	8.6	7.9	9.6
Sioux City, Iowa.....	9.0	9.4	9.3	9.1	9.3	9.6	9.7	10.7	10.4	11.4	12.1	12.2	12.2	13.1	13.3	13.6	14.9	12.1	11.0	10.8	11.4	10.6	10.4	10.2	11.0
Spokane, Wash.....	5.9	6.1	6.4	6.9	7.1	7.0	7.3	8.0	7.8	7.4	7.3	7.8	8.3	8.6	8.9	8.7	9.0	8.4	7.8	7.1	6.9	6.4	6.1	5.6	7.4
Springfield, Ill.....	11.0	10.5	10.1	10.1	10.2	10.3	10.7	10.8	11.2	11.9	12.8	12.7	13.6	13.8	13.5	13.6	12.7	11.4	10.8	10.7	11.1	11.5	11.2	11.1	11.6
Springfield, Mo.....	12.2	12.2	11.9	11.7	11.4	12.0	12.0	12.6	13.2	13.0	13.8	14.0	14.5	14.4	14.4	14.1	13.7	12.7	11.6	12.4	12.4	12.6	12.9	12.7	12.8
Tampa, Fla.....	5.5	5.6	5.5	5.6	5.3	4.6	5.8	5.6	7.2	8.3	9.1	9.1	9.8	9.1	9.3	8.8	7.7	6.1	6.2	5.7	6.0	5.6	6.1	5.4	6.8
Tatoosh Island, Wash.	15.8	17.7	17.7	18.9	19.5	21.3	20.1	21.1	20.1	19.6	19.6	18.7	17.3	18.9	18.3	18.0	17.7	18.1	16.7	17.9	18.4	19.5	18.8	17.4	18.6
Toledo, Ohio.....	11.8	10.6	10.5	11.0	10.8	10.5	10.0	10.3	11.1	12.5	13.5	14.1	13.7	14.0	14.4	13.5	12.9	11.9	12.4	12.3	13.0	12.4	11.9	11.9	12.1
Vicksburg, Miss.....	8.8	8.2	7.9	7.4	7.1	8.0	8.0	8.2	8.0	8.9	9.0	9.2	9.4	9.2	9.0	8.5	8.2	7.5	7.0	8.1	8.6	8.8	8.5	9.2	8.4
Vineyard Haven, Mass	9.0	9.5	9.8	9.8	10.0	9.6	9.6	10.0	10.3	11.2	11.6	11.8	11.7	10.8	10.2	9.8	9.4	8.9	8.9	9.0	8.9	9.2	9.1	9.4	9.9
Walla Walla, Wash...	7.2	7.6	7.5	7.7	7.5	7.4	7.1	6.9	7.5	7.4	7.1	6.5	7.2	8.4	8.7	8.9	9.1	7.6	7.0	6.5	7.2	7.0	7.2	7.2	7.5
Washington, D. C.....	4.9	4.6	4.8	5.0	4.6	5.4	4.8	5.7	6.9	8.1	9.1	9.4	10.0	10.5	10.3	9.4	7.9	6.2	5.5	5.4	5.6	5.4	5.6	5.5	6.7
Wichita, Kans.....	9.9	9.9	9.6	9.3	10.0	9.8	9.6	9.6	10.1	11.0	12.9	12.9	12.8	13.4	13.0	12.6	12.4	10.9	8.9	8.3	8.6	9.2	9.9	9.6	10.6
Williston, N. Dak.....	8.5	9.3	9.4	9.0	9.3	9.0	9.1	9.4	9.1	9.3	9.7	10.9	10.9	12.1	11.2	11.5	11.3	11.4	9.7	8.9	9.2	8.8	9.2	8.2	9.8
Wilmington, N. C.....	6.8	6.3	6.6	6.7	6.6	6.3	7.0	7.1	7.2	7.7	8.5	8.9	9.0	9.0	8.9	9.2	8.5	7.2	7.0	7.0	7.1	7.2	6.6	6.7	7.5
Winnemucca, Nev....	8.2	8.3	8.9	9.9	9.9	10.0	9.1	9.2	8.8	10.5	9.7	10.3	11.0	11.0	12.5	13.8	13.5	13.3	12.6	10.8	9.2	9.1	10.2	8.9	10.4
Woods Hole, Mass....	17.0	17.4	17.9	18.3	17.3	17.5	17.3	17.4	18.1	18.5	19.4	19.0	18.3	17.9	17.2	18.7	17.6	17.0	17.4	17.6	17.5	18.1	17.7	17.5	17.8
Yuma, Ariz.....	4.2	4.4	4.7	5.1	4.8	5.1	4.7	5.1	5.4	5.9	6.1	7.6	9.9	10.1	9.6	9.1	9.2	9.2	9.4	7.7	5.7	5.4	4.2	4.3	6.5

* For 24 days only.

TABLE VIII.—This table is now made out by the River and Flood Service, and is, therefore, published on page 408.

TABLE IX.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during November, 1896.*

Stations.	Component direction from—				Resultant.		Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.		N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*		*Hours.*	*Upper Lake Region*—Cont'd.		*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	23	19	9	20	n. 70 w.	12	Milwaukee, Wis	16	18	7	28	s. 85 w.	21
Portland, Me	27	16	10	23	p. 50 w.	17	Greenbay, Wis	14	18	12	29	s. 77 w.	18
Northfield, Vt	22	31	4	10	s. 54 w.	11	Duluth, Minn	20	12	12	29	n. 65 w.	19
Boston, Mass	17	21	6	33	s. 82 w.	27	*North Dakota.*						
Nantucket, Mass	18	22	12	22	s. 68 w.	11	Moorhead, Minn	39	5	4	24	n. 30 w.	39
Woods Hole, Mass.*	5	13	6	15	s. 48 w.	12	Bismarck, N. Dak	29	6	17	25	n. 19 w.	24
Block Island, R. I	20	19	14	26	n. 85 w.	12	Williston, N. Dak	26	11	18	18	n.	15
New Haven, Conn	25	18	5	23	n. 69 w.	19	*Upper Mississippi Valley.*						
Middle Atlantic States.							St. Paul, Minn	19	14	13	30	n. 74 w.	18
Albany, N. Y	16	28	5	20	s. 51 w.	19	La Crosse, Wis.†	9	10	2	14	s. 85 w.	12
Binghamton, N. Y†	9	7	6	11	n. 68 w.	5	Davenport, Iowa	18	18	12	27	w.	15
New York, N. Y	19	17	13	29	n. 83 w.	16	Des Moines, Iowa	23	15	17	20	n. 21 w.	8
Harrisburg, Pa	18	13	19	34	n. 45 w.	7	Dubuque, Iowa	23	18	7	26	n. 75 w.	20
Philadelphia, Pa	23	19	8	25	n. 77 w.	18	Keokuk, Iowa	15	21	12	24	s. 68 w.	13
Atlantic City, N. J	19	21	10	25	s. 82 w.	15	Cairo, Ill	19	27	16	10	s. 18 e.	19
Baltimore, Md	16	17	18	22	s. 76 w.	4	Springfield, Ill	18	27	6	18	s. 53 w.	15
Washington, D. C	22	28	8	12	s. 34 w.	7	Hannibal Mo	15	24	10	26	s. 61 w.	18
Lynchburg, Va	15	21	17	22	s. 40 w.	8	St. Louis, Mo	19	27	12	14	s. 14 w.	8
Norfolk, Va	20	25	14	17	s. 31 w	6	*Missouri Valley.*						
South Atlantic States.							Columbia, Mo.*	7	11	8	12	s. 45 w.	6
Charlotte, N. C	14	30	23	4	s. 50 e.	25	Kansas City, Mo	20	22	13	19	s. 72 w.	6
Hatteras, N. C	25	18	15	16	n. 8 w.	7	Springfield, Mo	22	28	15	7	s. 53 e	10
Raleigh, N. C	21	22	15	17	s. 63 w.	2	Omaha, Nebr	31	12	12	23	n. 30 w.	22
Wilmington, N. C	28	18	15	11	n. 22 e.	11	Sioux City, Iowa†	16	4	8	10	n. 9 w.	12
Charleston, S. C	25	13	29	8	n. 60 e.	24	Pierre, S. Dak	27	9	22	15	n. 21 e.	19
Augusta, Ga	19	12	18	20	n. 16 w.	7	Huron, S. Dak	28	11	14	21	n. 22 w.	18
Savannah, Ga	26	15	21	8	n. 50 e.	17	*Northern Slope.*						
Jacksonville, Fla	30	11	28	6	n. 40 e.	29	Havre, Mont	25	5	11	32	n. 46 w.	29
Florida Peninsula.							Miles City, Mont	31	11	18	17	n. 3 e.	30
Jupiter, Fla	11	12	40	4	s. 88 e.	36	Helena, Mont	10	16	2	42	s. 81 w.	40
Key West, Fla	30	5	46	2	n. 71 e.	46	Rapid City, S. Dak	24	19	15	19	n. 39 w.	6
Tampa, Fla	34	3	29	7	n. 35 e.	38	Cheyenne, Wyo	18	14	0	37	n 84 w.	37
Eastern Gulf States.							Lander, Wyo	12	19	10	34	s. 74 w.	25
Atlanta, Ga	17	18	27	16	s. 85 e.	11	North Platte, Nebr	19	14	14	27	n. 69 w.	14
Pensacola, Fla	22	13	33	2	n. 74 e.	32	*Middle Slope.*						
Mobile, Ala	26	18	19	6	n. 58 e.	15	Denver, Colo	20	25	12	16	s. 39 w.	6
Montgomery, Ala	18	9	37	8	n. 73 e.	30	Pueblo, Colo	22	13	16	24	n. 42 w.	12
Vicksburg, Miss	16	25	34	2	s. 74 e.	33	Concordia, Kans	30	21	5	14	n. 45 w.	13
New Orleans, La	25	11	34	3	n. 67 e.	34	Dodge City, Kans	27	19	18	10	n. 45 e.	11
Western Gulf States.							Wichita, Kans	26	29	9	5	s. 55 e.	5
Shreveport, La	16	29	25	8	s. 52 e.	22	Oklahoma, Okla	27	26	8	9	n. 45 w.	1
Fort Smith, Ark	16	11	28	13	n. 72 e.	16	*Southern Slope.*						
Little Rock, Ark	22	29	9	9	s.	7	Abilene, Tex	22	29	13	12	s. 8 e.	7
Corpus Christi, Tex	26	19	24	7	n. 66 e.	18	Amarillo, Tex	18	32	9	10	s. 4 w.	14
Galveston, Tex	15	26	30	4	s. 67 e.	28	*Southern Plateau.*						
Palestine, Tex	21	26	14	9	s. 45 e.	7	El Paso, Tex	23	4	19	29	n. 28 w.	22
San Antonio, Tex	25	30	25	2	n. 78 e.	24	Santa Fe, N. Mex	23	20	23	11	n. 76 e.	12
Ohio Valley and Tennessee.							Phœnix, Ariz	2	29	12	27	s. 29 w.	31
Chattanooga, Tenn	17	31	13	14	s. 4 w.	14	Yuma, Ariz	33	10	21	7	n. 31 e.	27
Knoxville, Tenn	29	11	24	11	n. 86 e.	22	*Middle Plateau.*						
Memphis, Tenn	32	22	23	10	n. 86 e.	13	Carson City, Nev	10	23	15	24	s. 35 w.	16
Nashville, Tenn	17	23	20	12	s. 53 e.	10	Winnemucca, Nev	15	19	15	21	s. 56 w.	7
Lexington, Ky	14	29	7	25	s. 50 w.	23	Salt Lake City, Utah	12	23	21	19	s. 10 e.	11
Louisville, Ky	12	29	15	16	s. 3 w.	17	*Northern Plateau.*						
Indianapolis, Ind	16	29	8	22	s. 47 w.	19	Baker City, Oreg	12	34	14	17	s. 8 w.	22
Cincinnati, Ohio	10	29	19	17	s. 6 e.	19	Idaho Falls, Idaho	16	38	2	11	s. 22 w.	24
Columbus, Ohio	13	28	10	24	s. 43 w.	20	Spokane, Wash	13	26	18	16	s. 9 e.	13
Pittsburg, Pa	10	30	11	22	s. 29 w.	23	Walla Walla, Wash	2	42	3	17	s. 18 w.	40
Parkersburg, W. Va	12	26	16	17	s. 4 w.	14	*North Pacific Coast Region.*						
Lower Lake Region.							Fort Canby, Wash	18	12	26	11	n. 68 e.	16
Buffalo, N. Y	9	22	8	31	s. 61 w	26	Port Angeles, Wash.*	2	9	14	6	s. 49 e.	11
Oswego, N. Y	8	33	8	22	s. 29 w.	29	Seattle, Wash	22	26	19	5	s. 74 e.	15
Rochester, N. Y	7	28	11	34	s. 48 w.	31	Tatoosh Island, Wash	10	11	29	19	s. 84 e.	10
Erie, Pa	9	32	5	27	s. 44 w.	32	Portland, Oreg	12	24	24	13	s. 43 e.	16
Cleveland, Ohio	6	35	12	19	s. 14 w.	30	Roseburg, Oreg	15	24	14	17	s. 18 w.	10
Sandusky, Ohio	10	21	7	35	s. 68 w.	30	*Middle Pacific Coast Region.*						
Toledo, Ohio	10	26	12	30	s. 48 w.	24	Eureka, Cal	15	20	20	18	s. 22 e.	5
Detroit, Mich	9	25	8	30	s. 52 w.	28	Redbluff, Cal	31	15	14	18	n. 14 w.	16
Upper Lake Region.							Sacramento, Cal						
Alpena, Mich	9	30	10	34	s. 65 w.	26	San Francisco, Cal	20	16	8	29	n. 79 w.	21
Grand Haven, Mich	19	16	17	23	n. 63 w.	7	*South Pacific Coast Region.*						
Marquette, Mich	16	19	5	31	s. 83 w.	26	Fresno, Cal	25	7	18	27	n. 27 w.	20
Port Huron, Mich	12	28	9	27	s. 48 w.	24	Los Angeles, Cal	21	6	18	24	n. 22 w.	16
Sault Ste. Marie, Mich	17	19	22	19	s. 56 e.	4	San Diego, Cal	31	7	16	25	n. 31 w.	26
Chicago, Ill	12	23	6	30	s. 65 w.	26	San Luis Obispo, Cal	34	9	8	21	n. 27 w.	28

*From observations at 8 p. m. only. †From observations at 8 a. m. only.

TABLE X.—*Thunderstorms and auroras, November, 1896.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	53	T.				5							1	3																				9	3	T.
		A.																																0	0	A.
Arizona	48	T.	1	1																														2	2	T.
		A.																																0	0	A.
Arkansas	51	T.			4	2																				1		8	2	1				18	6	T.
		A.																																0	0	A.
California	197	T.																	1															1	1	T.
		A.																																0	0	A.
Colorado	70	T.																									2							2	1	T.
		A.																																0	0	A.
Connecticut	22	T.					1		1																									2	1	T.
		A.																																0	0	A.
Delaware	6	T.						1																										1	1	T.
		A.	1																															1	1	A.
Dist. of Columbia	4	T.																																2	2	T.
		A.																																0	0	A.
Florida	38	T.	1		2	4	1							4	2									1			1							16	8	T.
		A.																																0	0	A.
Georgia	49	T.			1		1						5	7															1					15	5	T.
		A.																																0	0	A.
Idaho	36	T.																																3	3	T.
		A.					1									1	1										1	4	1					33	9	T.
Illinois	97	T.		6	12	5			2	1			1											1			2							1	1	A.
		A.																																0	0	T.
Indiana	48	T.																	1															2	2	A.
		A.																																0	0	T.
Indian Territory	6	T.																																1	1	A.
		A.																																0	0	T.
Iowa	101	T.			3																													3	2	A.
		A.				1						1																						0	0	T.
Kansas	73	T.																																11	3	A.
		A.					1																											2	2	T.
Kentucky	47	T.				1																												14	3	A.
		A.																																4	3	T.
Louisiana	48	T.			1	3		2	5				4	4									1		3									2	2	A.
		A.																																0	0	T.
Maine	16	T.																																36	13	A.
		A.																																0	0	T.
Maryland	31	T.				1	2						1																					0	0	A.
		A.						1																										4	3	T.
Massachusetts	77	T.					4	1							1	1										1			1					3	A.
		A.			1			1	1					1																				7	4	T.
Michigan	96	T.					2												2	7	1													4	4	A.
		A.																																11	3	T.
Minnesota	69	T.		2	1				1																		6							1	1	A.
		A.																																9	3	T.
Mississippi	52	T.		1		5			2				1	2									1				1	3	6	2				1	1	A.
		A.																																24	10	T.
Missouri	96	T.		2	11	4						1	1								2						2	5						0	0	A.
		A.						1																										28	8	T.
Montana	40	T.																																1	1	A.
		A.							1	1																								0	0	T.
Nebraska	112	T.																											1					3	3	A.
		A.			1																						27	4						31	2	T.
Nevada	39	T.																								1	1		1					4	4	A.
		A.																																0	0	T.
New Hampshire	23	T.																																0	0	A.
		A.						1	1						1	1																		4	4	T.
New Jersey	54	T.					5																											5	1	A.
		A.						1																										1	1	T.
New Mexico	36	T.																																0	0	A.
		A.																																0	0	T.
New York	93	T.					4	3											1															0	0	A.
		A					1	2																					1					9	4	T.
North Carolina	60	T.					1						4	15																				3	2	A.
		A.																						1										21	4	T.
North Dakota	39	T.																																0	0	A.
		A.						2																										2	1	T.
Ohio	140	T.																																2	1	A.
		A.			1			1				1						1	1	1			1		1			1						8	2	T.
Oklahoma	39	T.			1																						6							7	0	A.
		A.																																0	0	T.
Oregon	60	T.	1												1					1		1												4	4	A.
		A.																																0	0	T.
Pennsylvania	93	T.					10	1											1															12	3	A.
		A.					1																			1								1	1	T.
Rhode Island	6	T.																																1	1	A.
		A.						1																										0	0	T.
South Carolina	42	T.											2	13							1													1	1	A.
		A.																											4					20	4	T.
South Dakota	46	T.																																0	0	A.
		A.						1																			2							2	1	T.
Tennessee	49	T.				1	1						11	5					1									1	1					3	3	A.
		A.					1																				5	12	2					37	7	T.
Texas	91	T.			4	1		3	1										1	2			2				5	2		1				1	1	A.
		A.																																22	10	T.
Utah	32	T.																									1							0	0	A.
		A.																																1	1	T.
Vermont	13	T.					2																											0	0	A.
		A.																																2	1	T.
Virginia	37	T.																																0	0	A.
		A.									1																							0	0	T.
Washington	51	T.																																1	1	A.
		A.						1																										1	1	T.
West Virginia	37	T.																																0	0	A.
		A.																																0	0	T.
Wisconsin	58	T.			1	1													1	1					1	1	1	1					8	3	A.
		A.						1		1			1																					8	8	T.
Wyoming	11	T.																				1				1	1							6	6	A.
		A.																																0	0	T.
Sums	2,713	T.	3	12	41	33	34	10	10	1	0	1	31	53	3	2	0	0	6	10	3	1	5	1	4	3	73	45	28	10	6	1	....	430	....	T.
		A.	1	0	3	1	5	12	8	2	0	3	0	2	2	1	1	2	2	1	0	2	1	1	1	2	2	1	3	2	1	....		63	....	A.

TABLE XI.—*Hourly sunshine as deduced from sunshine recorders, November, 1896.*

Stations.	Instrument.	Percentages for each hour of local mean time ending with the respective hour.																Monthly summary.			
		A. M.								P. M.								Instrumental record.			Personal estimate.
		5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	Actual.	Possible.	Per cent of possible.	
																		Hours.	*Hours.*		
Atlanta, Ga	T.	.....	.....	52	47	50	51	53	53	51	52	46	42	44	33	.....	.....	152.8	312.2	49	50
Baltimore, Md	T.	.....	.....	22	13	14	26	42	44	43	47	30	16	9	.....	.....	.....	87.1	301.5	29	37
Binghamton, N. Y	T.	.....	.....	26	20	22	28	30	39	36	31	25	14	12	.....	.....	.....	76.8	294.9	26	26
Bismarck, N. Dak	P.	.....	.....	0	6	13	28	34	38	39	41	38	33	23	.....	.....	.....	83.4	281.0	30	31
Boston, Mass	T.	.....	.....	40	29	37	37	42	47	40	47	45	26	15	.....	.....	.....	110.2	294.9	37	31
Buffalo, N. Y	T.	.....	.....	9	3	10	26	31	34	38	36	23	14	11	.....	.....	.....	67.1	292.3	23	21
Chattanooga, Tenn	T.	.....	.....	17	16	25	39	48	58	57	54	50	49	33	50	.....	.....	128.5	310.1	41	40
Cheyenne, Wyo	P.	.....	.....	62	52	63	66	75	74	76	73	65	57	58	.....	.....	.....	196.4	297.3	66	45
Chicago, Ill	T.	.....	.....	28	23	28	37	46	45	45	36	35	34	34	.....	.....	.....	106.7	294.9	36	36
Cincinnati, Ohio	T.	.....	.....	26	21	23	30	38	53	59	49	46	33	28	.....	.....	.....	114.4	301.5	38	36
Cleveland, Ohio	T.	.....	.....	19	9	19	28	30	37	37	34	26	18	22	.....	.....	.....	76.8	294.9	25	20
Columbus, Ohio	T.	.....	.....	18	14	16	31	33	36	35	31	26	26	28	.....	.....	.....	83.2	299.7	28	25
Denver, Colo	P.	.....	.....	82	66	71	74	82	90	83	84	85	82	83	.....	.....	.....	239.6	299.7	80	53
Des Moines, Iowa	T.	.....	.....	34	42	42	43	46	52	57	49	44	36	28	.....	.....	.....	130.7	294.9	44	41
Detroit, Mich	T.	.....	.....	28	27	34	42	45	38	43	41	32	25	21	.....	.....	.....	104.3	294.9	35	27
Dodge City, Kans	P.	.....	.....	57	45	55	57	64	66	71	73	76	66	50	.....	.....	.....	187.2	304.0	62	59
Dubuque, Iowa	T.	.....	.....	25	23	23	24	30	35	32	33	[illegible]	27	25	.....	.....	.....	82.5	294.9	28	32
Eastport, Me	P.	.....	.....	24	14	23	33	36	33	27	26	29	28	23	.....	.....	.....	76.8	287.2	27	23
Eureka, Cal	P.	.....	.....	33	29	39	43	48	51	53	50	45	46	26	.....	.....	.....	128.6	297.3	43	41
Fresno, Cal	T.	.....	.....	53	50	54	62	71	76	79	77	76	68	62	100	.....	.....	205.5	305.7	67	58
Galveston, Tex	P.	.....	.....	18	20	38	41	50	53	58	65	51	47	33	21	.....	.....	140.0	321.7	44	51
Helena, Mont	P.	.....	.....	35	27	30	38	43	48	34	42	42	24	26	.....	.....	.....	100.7	281.0	36	35
Indianapolis, Ind	T.	.....	.....	24	17	28	33	39	61	68	63	57	51	35	.....	.....	.....	149.7	299.7	50	42
Kansas City, Mo	P.	.....	.....	49	46	46	52	56	58	58	58	53	52	50	.....	.....	.....	150.3	301.5	53	48
Little Rock, Ark	T.	.....	.....	36	36	40	53	60	63	61	59	56	44	41	50	.....	.....	157.3	310.1	51	40
Los Angeles, Cal	P.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	62
Louisville, Ky	T.	.....	.....	20	28	33	39	53	51	58	51	40	39	37	.....	.....	.....	129.8	304.0	43	31
Minneapolis, Minn	T.	.....	.....	3	10	16	35	39	46	41	36	28	22	15	.....	.....	.....	84.2	287.2	29	.....
New Orleans, La	T.	.....	.....	25	23	31	43	49	45	42	45	35	28	20	20	.....	.....	113.3	319.7	35	26
New York, N. Y	T.	.....	.....	28	28	47	59	61	62	61	58	53	48	32	.....	.....	.....	151.5	297.3	51	39
Northfield, Vt	P.	.....	.....	17	17	20	24	32	34	27	29	28	13	12	.....	.....	.....	64.2	289.7	22	21
Omaha, Nebr	P.	.....	.....	35	37	30	53	55	60	45	66	66	60	55	.....	.....	.....	152.7	297.3	51	47
Philadelphia, Pa	T.	.....	.....	43	37	44	51	64	64	60	56	55	51	48	.....	.....	.....	158.2	299.7	53	41
Phœnix, Ariz	P.	.....	.....	67	67	84	88	90	85	87	89	89	80	61	92	.....	.....	255.6	314.0	81	69
Portland, Me	T.	.....	.....	6	14	37	46	51	50	54	50	41	27	21	.....	.....	.....	115.3	289.7	40	29
Portland, Oreg	T.	.....	.....	13	17	21	28	28	25	26	26	23	17	11	.....	.....	.....	64.8	284.1	23	25
Do	P.	.....	.....	18	15	20	29	30	26	22	24	21	20	11	.....	.....	.....	64.3	284.1	23	25
Raleigh, N. C	T.	.....	.....	22	42	56	62	69	80	77	75	71	59	48	50	.....	.....	189.5	308.3	61	53
Rochester, N. Y	T.	.....	.....	28	17	26	32	32	36	22	28	18	16	7	.....	.....	.....	70.9	292.3	24	25
St. Louis, Mo	T.	.....	.....	36	35	42	50	54	59	49	47	50	40	37	.....	.....	.....	138.8	301.5	46	36
Salt Lake City, Utah	P.	.....	.....	35	34	38	42	43	46	47	47	43	42	42	.....	.....	.....	125.3	297.3	42	22
San Diego, Cal	P.	.....	.....	70	71	70	69	79	83	85	90	83	80	76	88	.....	.....	246.0	314.0	78	73
San Francisco, Cal	T.	.....	.....	0	21	50	61	66	78	81	82	77	69	28	.....	.....	.....	182.4	304.0	60	51
Santa Fe, N. Mex	P.	.....	.....	74	78	89	89	91	90	91	85	87	82	68	50	.....	.....	261.0	308.3	85	69
Savannah, Ga	P.	.....	.....	43	45	49	52	55	51	50	59	58	58	51	42	.....	.....	164.8	315.9	52	50
Seattle, Wash	T.	.....	.....	8	14	19	19	20	28	27	25	23	22	19	.....	.....	.....	60.7	278.0	22	31
Tampa, Fla	T.	.....	.....	52	50	54	75	74	75	69	66	53	36	52	49	.....	.....	193.2	323.5	60	64
Vicksburg, Miss	T.	.....	.....	50	49	60	65	82	80	78	77	75	70	65	67	.....	.....	218.1	315.9	69	67
Washington, D. C	P.	.....	.....	41	28	34	46	57	50	57	56	54	45	41	.....	.....	.....	141.3	301.5	47	44
Wilmington, N. C	T.	.....	.....	34	34	44	60	68	73	77	76	70	66	44	33	.....	.....	186.2	312.2	60	60

TABLE XII.—*Maximum rainfall in one hour or less, November, 1896.*

Stations.	Maximum rainfall in—						Stations.	Maximum rainfall in—					
	5 min.	Date.	10 min.	Date.	1 hour.	Date.		5 min.	Date.	10 min.	Date.	1 hour.	Date.
	Inch.		*Inch.*		*Inch.*			*Inch.*		*Inch.*		*Inch.*	
Atlanta, Ga	0.35	12	0.40	3	0.80	3	Milwaukee, Wis‡	0.06	5	0.09	5	0.33	5
Baltimore, Md	0.17	29	0.30	29	0.23	29	Nantucket, Mass	0.09	12	0.14	11	0.45	11
Bismarck, N. Dak‡							Nashville, Tenn	0.06	21	0.11	21	0.39	21
Boston, Mass	0.10	8	0.12	8	0.30	8	New Orleans, La	0.05	28	0.08	28	0.18	28
Buffalo, N. Y	0.03	23	0.05	21	0.15	21	New York, N. Y	0.16	12	0.18	12	0.27	12
Chicago, Ill*							Norfolk, Va	0.05	25	0.08	25	0.26	25
Cincinnati, Ohio	0.09	27	0.13	27	0.32	27	Omaha, Nebr	0.02	18	0.04	18	0.18	18
Cleveland, Ohio	0.03	10	0.05	10	0.14	21	Philadelphia, Pa	0.04	11	0.07	11	0.27	11
Denver, Colo					0.01	25, 26	Pittsburg, Pa	0.04	5	0.07	5	0.29	5
Detroit, Mich	0.09	5	0.13	5	0.25	5	Portland, Me	0.12	4	0.19	4	0.49	14
Dodge City, Kans	0.04	25	0.04	25	0.17	25	Portland, Oreg	0.01	21	0.02	21	0.12	11
Duluth, Minn‡							Rochester, N. Y	0.14	3	0.18	3	0.39	3
Eastport, Me	0.20	5	0.30	5	0.50	5	St. Louis, Mo	0.12	25	0.15	25	0.29	25
Galveston, Tex	0.20	7	0.32	7	0.59	7	St. Paul, Minn	0.10	9	0.10	9	0.15	9
Indianapolis, Ind	0.08	26	0.13	26	0.42	26	Salt Lake City, Utah	0.05	25	0.10	25	0.25	25
Jacksonville, Fla	0.30	12	0.55	12	0.95	12	San Diego, Cal	0.08	23	0.14	23	0.55	23
Jupiter, Fla	0.31	13	0.45	13	0.57	13	San Francisco, Cal	0.07	30	0.09	1	0.35	1
Kansas City, Mo	0.05	26	0.10	26	0.45	26	Savannah, Ga†	0.04	7	0.07	7	0.36	7
Key West, Fla	0.22	7	0.40	7	0.93	7	Seattle, Wash	0.22	27	0.34	27	0.74	27
Little Rock, Ark*							Vicksburg, Miss	0.03	4	0.05	4	0.14	4
Louisville, Ky	0.10	11, 27	0.20	27	0.66	27	Washington, D. C	0.08	4	0.13	4	0.44	4
Memphis, Tenn*							Wilmington, N. C						

*Self-register out of order. †Partly estimated. ‡No record on account of snow.

TABLE XIII.—*Excessive precipitation, by stations, for November, 1896.*

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Alabama.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Brewton		2.50	29-30			
Bridgeport		3.25	11-12			
Do		2.57	27-28			
Decatur		3.41	27-28			
Hamilton		4.02	27-28			
Newburg		3.00	28			
Newton		2.64	12			
Scottsboro		3.40	11-12			
Union Springs		2.50	3-4			
Valleyhead		2.72	11			
Arizona.						
Farleys Camp		2.60	24-25			
Arkansas.						
Arkansas City		7.36	26-27			
Blanchard Springs		5.57	26-27			
Dallas		2.50	26			
Elon		5.25	26-27			
Helena		6.10	26-27			
Luna Landing		5.05	26-27			
Marvell		3.00	26-27			
Moore		2.50	4			
Osceola		3.40	26-27			
Picayune		3.50	26-27			
Stuttgart		5.41	26-27			
California.						
Bear Valley	18.35	9.60	22-24			
Bowmans Dam	19.40	2.91	16-17			
Do		2.60	30			
Do		6.85	23-24			
Crescent City	15.02	4.76	8			
Do		6.31	15-16			
Durham		2.80	23			
Edmanton	16.64	3.30	16			
Do		2.62	19			
Do		3.70	23			
Eureka		3.04	8-9			
Fordyce Dam	16.97	3.50	8			
Do		2.50	30			
Do		5.91	23-24			
Fort Bragg	14.65					
Georgetown	17.18	5.06	23-24			
Grass Valley	13.65	8.20	22-24			
Greenville		2.50	24			
Healdsburg		2.61	21			
Do		3.60	23			
Hydesville		3.60	8			
Iowa Hill	13.42	3.20	23-24			
Kennedy Gold Mine	10.71	3.10	8-9			
Do		4.36	24			
Laporte	23.87	2.95	9			
Do		3.06	17			
Do		10.31	23-24			
Los Gatos		2.70	24			
Malakoff Mine	17.42	10.19	22-24			
Middletown		3.00	23			
Mills College		3.33	23			
Mokelumne Hill		3.29	23			
Nevada City	12.63	3.78	24			
North San Juan	12.80					
Pilot Creek	15.74	2.65	8-9			
Do		4.75	24			
Placerville	11.71					
Quincy	11.26	3.40	24			
Redding		2.80	16			
San Francisco		2.79	23-24			
Santa Barbara		3.00	24			
Shasta	10.17	3.15	15			
Do		2.66	21-22			
Summerdale		6.31	23-24			
Upper Mattole	13.44	3.00	9			
Do		3.35	15-16			
Do		2.80	22			
Vacaville		3.04	23			
Colorado.						
Ruby		2.60	10			
Florida.						
De Funiak Springs		4.00	28			
Tallahassee		3.52	4			
Tampa		2.90	4-5	1.10	0 42	5
Tarpon Springs		4.61	3-4			
Georgia.						
Allentown		3.01	3-4			
Do		2.60	12			
Clayton	11.89	4.05	4			
Covington		3.50	12			
Dahlonega		2.95	11-12			
Diamond		3.05	11-12			
Gillsville		3.43	4			
Macon		3.85	3-4			
Marshallville		3.38	3			
Do		3.50	12			
Milledgeville		4.20	3-4			
Ramsey		3.35	11-12			
Toccoa		2.68	4-5			
Washington		4.63	2-3			
Idaho.						
Murray	11.12					
Indiana.						
Jeffersonville		2.53	27			

TABLE XIII.—*Excessive Precipitation.*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Indian Territory.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Eufaula		2.65	25			
Tulsa		2.50	26-27			
Iowa.						
Plover		2.62	26			
Spencer		2.85	26			
Spirit Lake		2.75	26			
Kentucky.						
Alpha		4.17	27-28			
Bowling Green		3.85	26-27			
Franklin		3.02	26-27			
Hopkinsville		3.59	26-27			
Marrowbone		2.50	27			
Middleboro		3.42	27-28			
Owenton		2.97	27-28			
Pleasure Ridge Park		2.64	27-28			
Russellville		3.54	27			
Louisiana.						
Amite		2.71	28-29			
Bastrop		2.95	27			
Cheneyville		3.50	27			
Davis		2.71	27			
Donaldsonville		2.90	29			
Farmerville		4.09	26-27			
Franklin		4.66	28-29			
Houma		2.65	28-29			
Lawrence		2.52	29			
Mansfield		2.75	26-27			
Maurepas		4.24	23			
Melville		2.50	13			
Monroe		3.60	28			
Oakridge		4.64	27-28			
Oberlin		4.00	27-28			
Paincourtville		3.15	27-28			
Robeline				2.02	1 45	23
Ruston		3.46	27			
Sugar Experiment Station		2.70	28			
Thibodeaux		2.75	23			
White Sulphur Springs		4.30	27			
Maine.						
North Bridgton		3.06	5-6	1.00	0 45	6
Maryland.						
Bœttcherville		3.00	4-5			
Cumberland		2.68	4-5			
Fallston		2.72	4-5			
Flintstone		2.95	4-5			
Massachusetts.						
Cohasset		2.58	13			
Michigan.						
Marquette		2.78	25-26			
Rockland		2.80	26			
Minnesota.						
Lesueur		3.00	25			
New Ulm		2.55	26			
Mississippi.						
Agricultural College		3.10	28			
Austin		6.55	26-27			
Batesville		3.95	28			
Briers		3.20	28			
Brookhaven		3.30	27-28			
Canton		3.85	28			
Columbus		2.80	27-28			
French Camps		2.57	27-28			
Greenville		3.80	27-28			
Kosciusko		3.00	27			
Louisville		2.66	28			
Magnolia		2.96	21			
Fort Gibson				1.88	1 30	13
Rosedale		5.25	26			
Water Valley		2.55	26-27			
Missouri.						
Gayoso		4.00	26-27			
Lamar		2.92	25			
Virgil City		2.57	25-26			
Nebraska.						
David City		2.60	25-26			
Schuyler		2.75	25			
New Hampshire.						
Plymouth		2.81	4-5			
New Jersey.						
Charlotteburg		3.73	5-6			
Chester		3.40	4-5			
Dover		3.27	4-5			
Junction		2.60	4-5			
New York.						
Bedford		3.29	4-5			
Catskill		2.56	4-5			
Glens Falls		3.05	4-5			
Gloversville		2.56	4-5			
Lake George		2.62	4-5			
Mohonk Lake		3.28	5			
North Lake		3.00	5			
Westpoint		3.80	5-6			
North Carolina.						
Bryson City		3.35	11-12			
Flatrock		3.65	4			
Highlands	11.74					
Horse Cove	12.15	3.33	3-4			
Do		2.87	11-12			
Lynn	10.21	5.40	3-4			
Marion		4.45	4-5			

TABLE XIII.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
North Carolina—Continued.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Mocksville		3.90	4-5			
Monoure		2.90	4-5			
Morganton		3.65	4			
Mountairy		3.04	4			
Do		2.93	28-29			
Mount Pleasant		2.86	3-4			
Murphy		3.52	11-12			
Oakridge		2.66	4			
Saxon		3.20	4			
Settle		2.56	4-5			
Skyuka	10.76	5.78	4-5			
Wilkesboro		3.43	4			
Oklahoma.						
Burnett		3.44	25-26			
Clifton		2.53	25-26			
Keokuk Falls		2.54	25-26			
Norman		3.20	25-26			
Sac and Fox Agency		3.00	25-26			
Oregon.						
Astoria	16.56					
Aurora (near)	16.73	2.54	8			
Do		2.97	15			
Bandon	11.68	2.62	15			
Bay City	18.50					
Cascade Locks	23.65	2.75	7			
Do		5.95	13-14			
Corvallis	16.69	3.02	14			
Eugene	11.86					
Falls City	24.61	2.87	8			
Do		7.64	14-15			
Forest Grove	18.37	6.08	13-14			
Gardiner	18.18	2.50	8			
Do		2.95	14			
Glenora	39.26	4.05	8			
Do		16.31	13-15			
Government Camp	25.31	3.94	8			
Do		6.03	14-15			
Hood River (near)	16.55	4.10	8			
Hubbard	17.53	3.45	8			
Do		5.95	14-15			
Langlois	26.95	3.10	8			
Do		15.85	14-17			
McMinnville	20.47	3.45	8			
Do		6.18	14-15			
Mount Angel	15.09					
Nehalem	26.32	5.08	7			
Newberg	18.64	3.04	8			
Do		6.39	14-15			
Newport	21.01	6.10	8			
Do		2.65	15			
Portland	13.12	2.65	7-8			
Do		2.77	14-15			
Roseburg		2.82	15			
Salem	16.90	3.60	8			
Do		5.54	14-15			
Stafford	19.27	4.02	8			
Do		6.66	15-16			
Toledo	18.72	2.55	30			
Vernonia	13.00					
Pennsylvania.						
Blooming Grove		3.90	4-5			
Chambersburg		2.70	4-5			
Cooperasburg		2.65	5			
Duncannon		2.71	4			
East Mauch Chunk		3.85	4-5			
Girardville		5.30	4-5			
Lewisburg		3.43	4-5			
Selsholtzville		3.42	4-5			
South Eaton		2.82	4-5			
White Haven		3.17	4-5			
South Carolina.						
Anderson		3.16	28-29			
Clemson College		3.75	3-4			
Greenville		4.58	3-4			

TABLE XIII.—*Excessive precipitation.*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
South Carolina—Continued.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Greenwood		4.74	3-5			
Mount Carmel		5.36	3-4			
Spartanburg		3.85	3-4			
Tennessee.						
Andersonville		3.45	27-28			
Ashwood		5.10	27-28			
Benton		3.60	11-12			
Bolivar		5.84	27-28			
Byrdstown		4.68	27-28			
Carthage		5.00	27-28			
Chattanooga		2.73	11-12			
Clarksville		4.90	26-27			
Clinton		4.07	27-28			
Cookeville		4.21	27-28			
Decatur		2.77	11-12			
Do		2.78	27-28			
Elk Valley		3.22	28			
Fairmount		2.57	27-28			
Florence		3.77	27			
Harriman		3.50	27-28			
Hohenwald		4.33	27-28			
Jackson		4.68	26-27			
Johnsonville		5.06	26-27			
Liberty		5.35	27-28			
McMinnville		4.60	27-28			
Memphis		5.10	26-27			
Molino		3.62	11-12			
Do		4.00	27-28			
Nashville		3.37	27-28			
Nunnelly		4.27	26-27			
Palmetto		3.45	27-28			
Pope		5.09	26-27			
Riddleton		3.79	26-27			
Rockwood		2.80	11-12			
Do		2.90	27-28			
Rugby		3.70	27-28			
Sewanee		3.38	11-12			
Do		2.62	27-28			
Tellico Plains		2.53	11-12			
Trenton		4.38	26-27			
Tullahoma		3.10	27-28			
Waynesboro		3.23	27-28			
Texas.						
Arthur City		3.69	25-26			
Brenham				2.00	0 50	27
Gainesville		4.25	25-26			
Stafford				1.75	1 00	21
Virginia.						
Clifton Forge		3.00	3-4			
Guinea		2.65	4			
Hot Springs		2.50	4			
Nottoway		3.43	28-29			
Salem		2.73	4-5			
Stanardsville		2.70	4-5			
Washington.						
Ashford	16.15	2.50	8			
Chehalis	12.19					
Elma	11.61					
Fort Canby	15.12	3.00	20-21			
Grandmound	14.08					
La Center	14.28	2.65	7			
Lapush	14.51					
Madrone	11.86					
Mayfield	16.19					
Montecristo	17.50	2.61	13			
North Bend	18.55	2.54	9			
Do		2.80	13			
Olympia	13.98	2.70	13			
Silvercreek	14.32					
Southbend	15.65					
Tatoosh Island	14.16	2.62	12-13			
Union City	19.39	8.80	12-13			
Vashon	11.24					
West Ferndale	10.80					

Chart I.—Tracks of Centers of Low Areas, November, 1896

Chart I. Tracks of Centers of Low Areas. November, 1896.

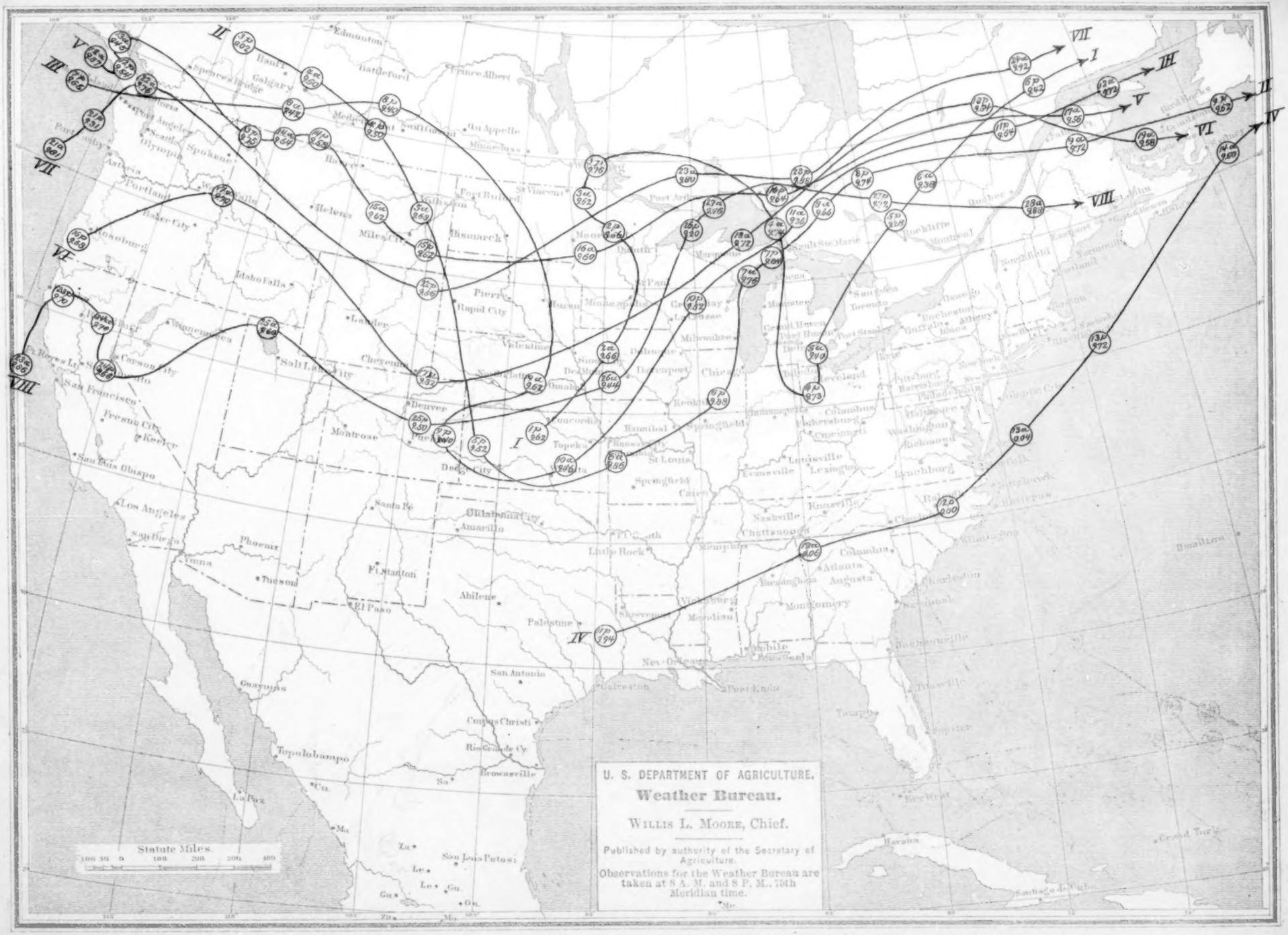


Chart II. Tracks of Centers of High Areas. November, 1896.

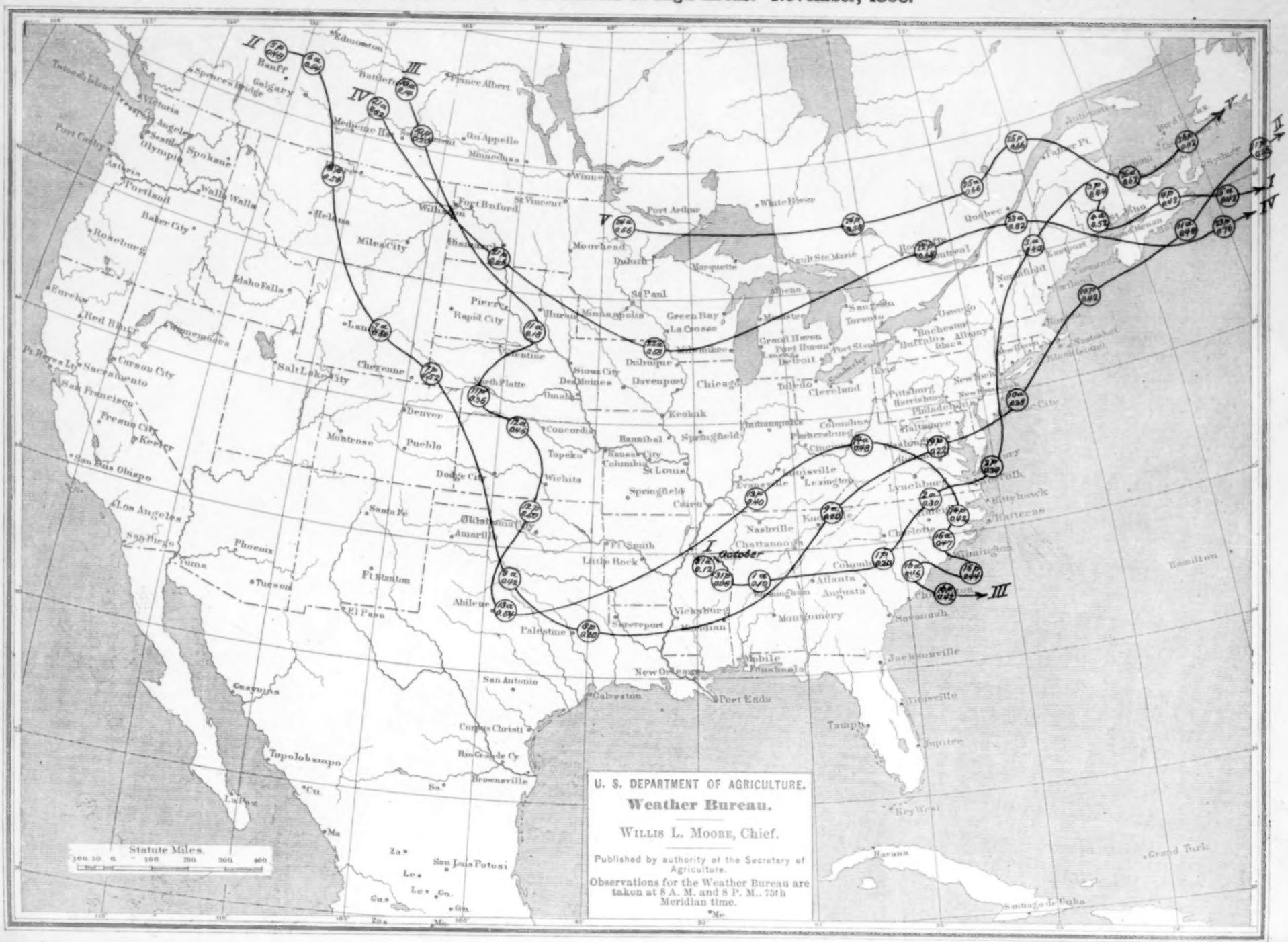


Chart III. Total Precipitation. November, 1896.

Chart III. Total Precipitation. November, 1896.

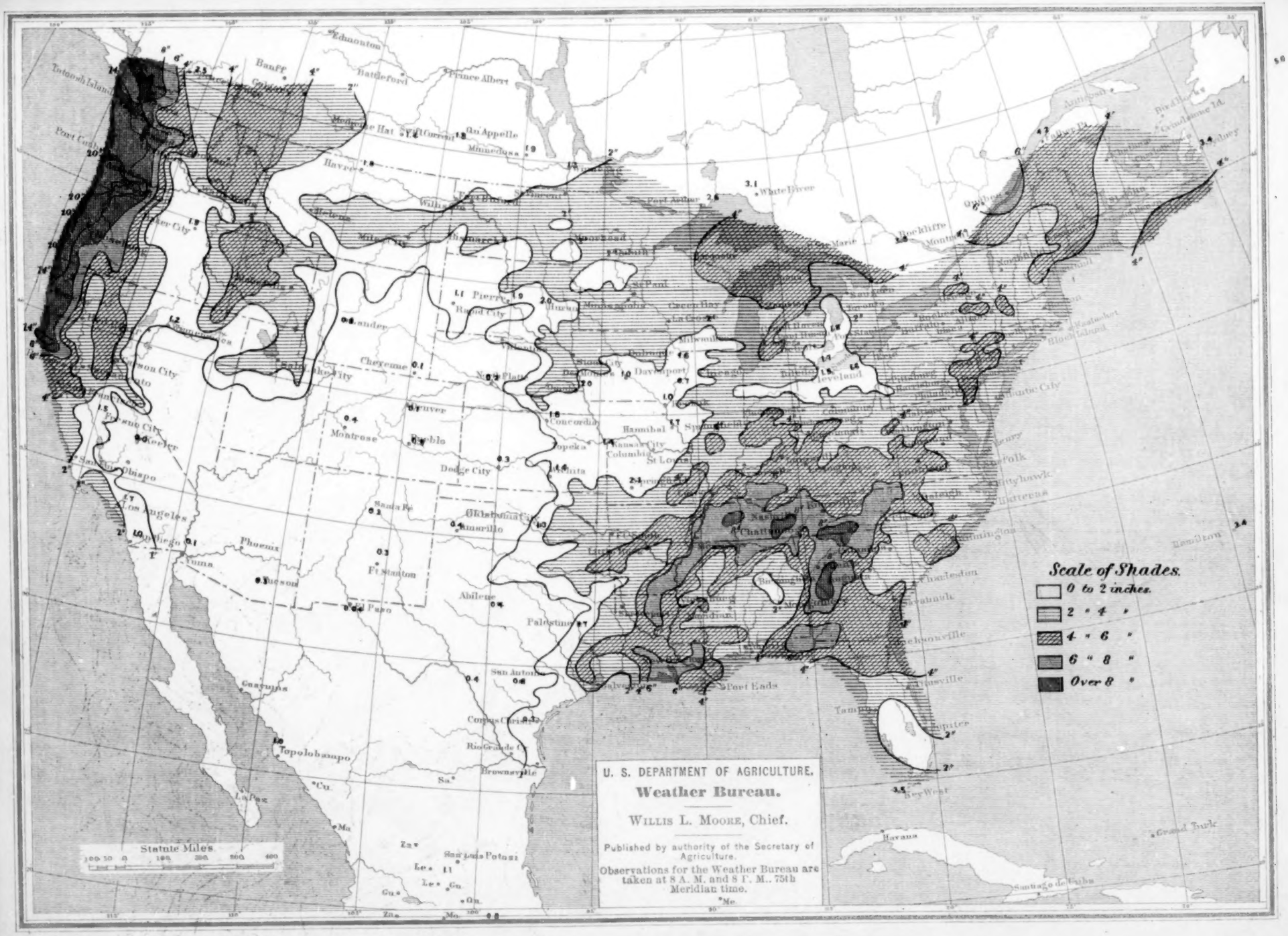

Scale of Shades.
0 to 2 inches.
2 " 4 "
4 " 6 "
6 " 8 "
Over 8 "
Statute Miles
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.

Chart IV. Isobars, Isotherms, and Resultant Winds. November, 1896.

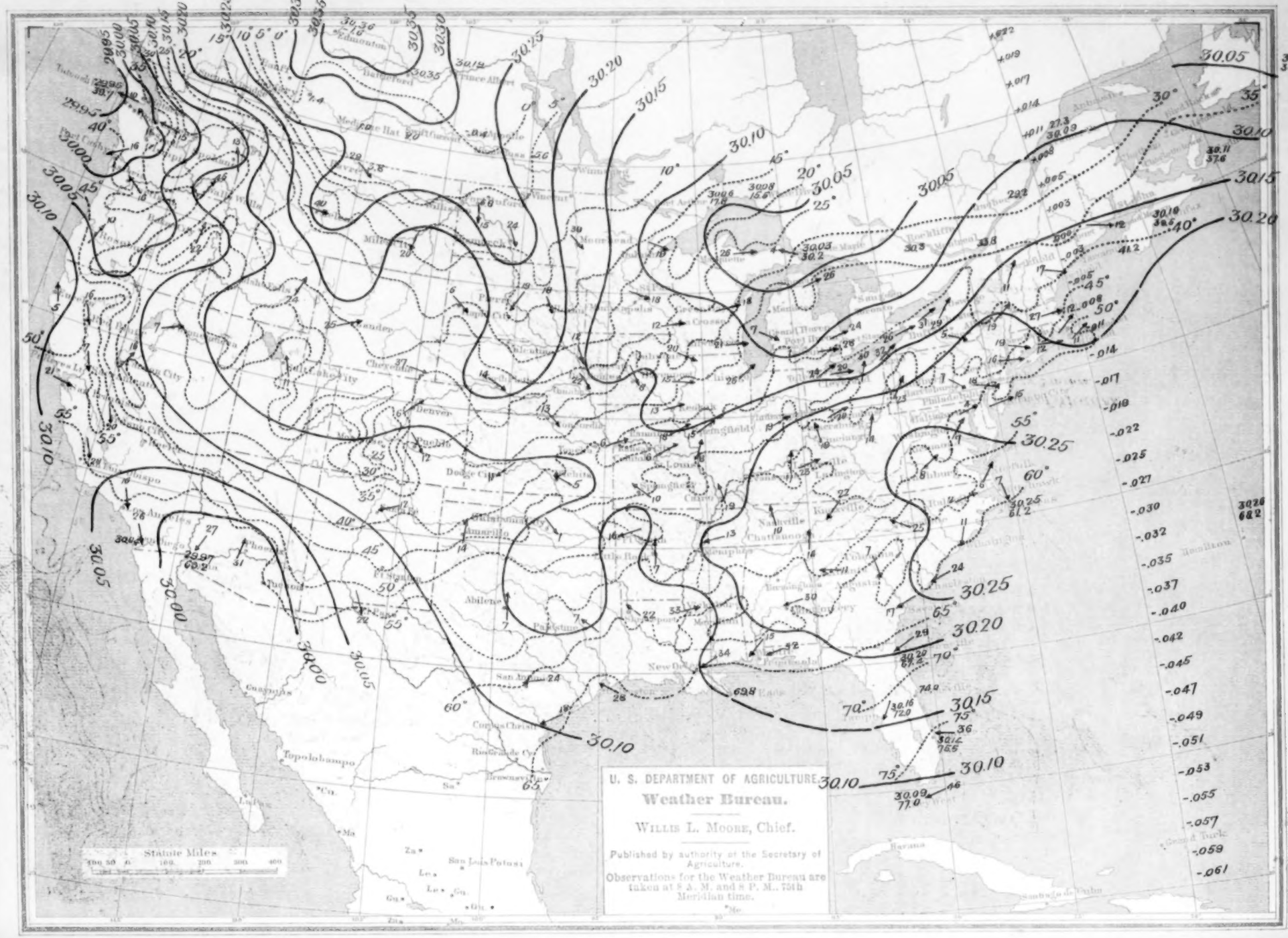

U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.
Statute Miles

Chart V. Depth of Snowfall (inches) and Limits of Freezing Weather. November, 1896.

Chart V. Depth of Snowfall (inches) and Limits of Freezing Weather. November, 1896.

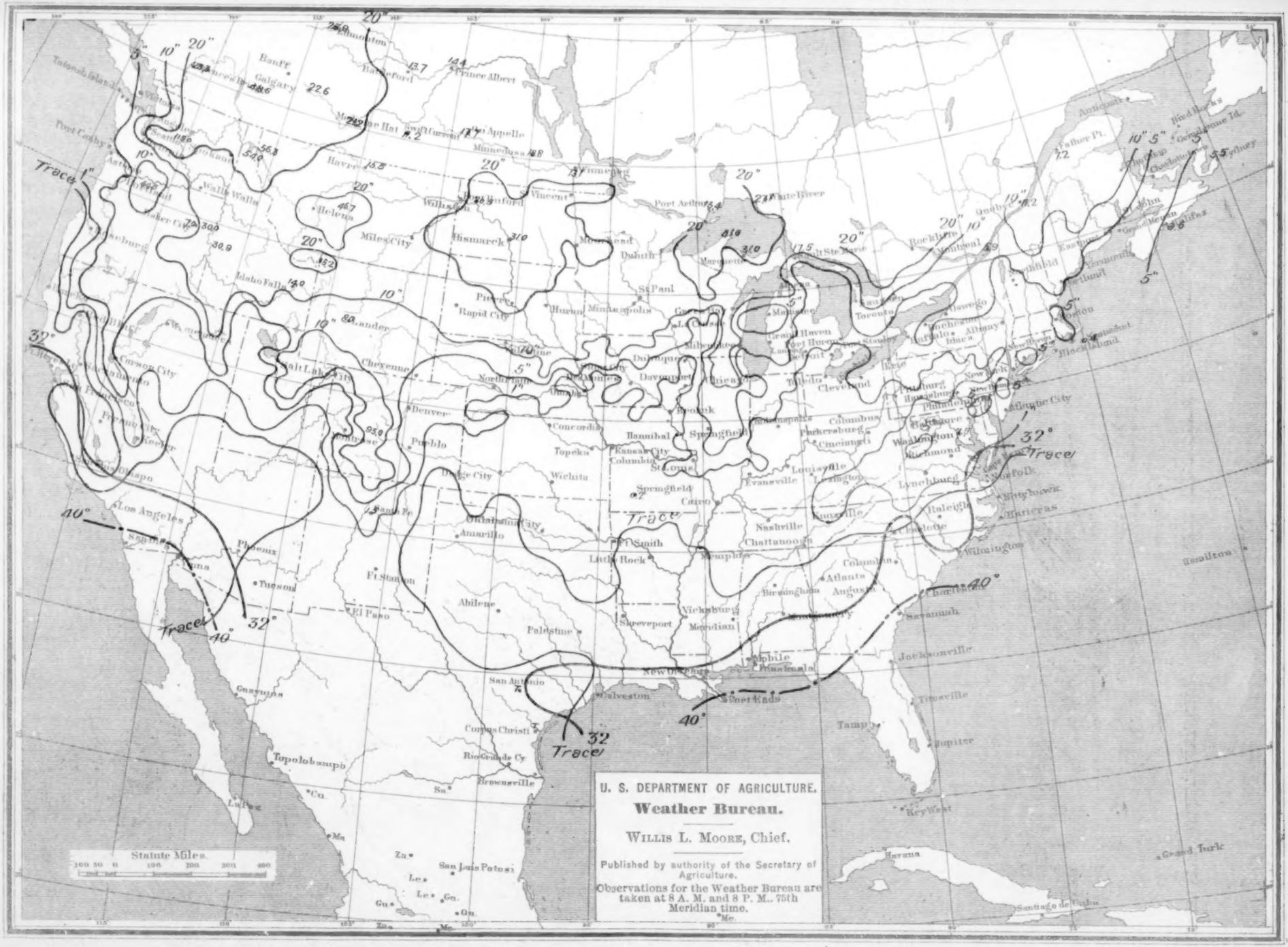

U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.
Statute Miles.
100 50 0 100 200 300 400
Trace
32°
40°

Chart VI. Depth of Snow on Ground at the Close of the Month. November, 1896.

U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.
Statute Miles.
100 50 0 100 200 300 400
Trace
1"
5"
10"
20"

Chart VII. Isobars at 5,000 Meters Altitude. Normals for December.

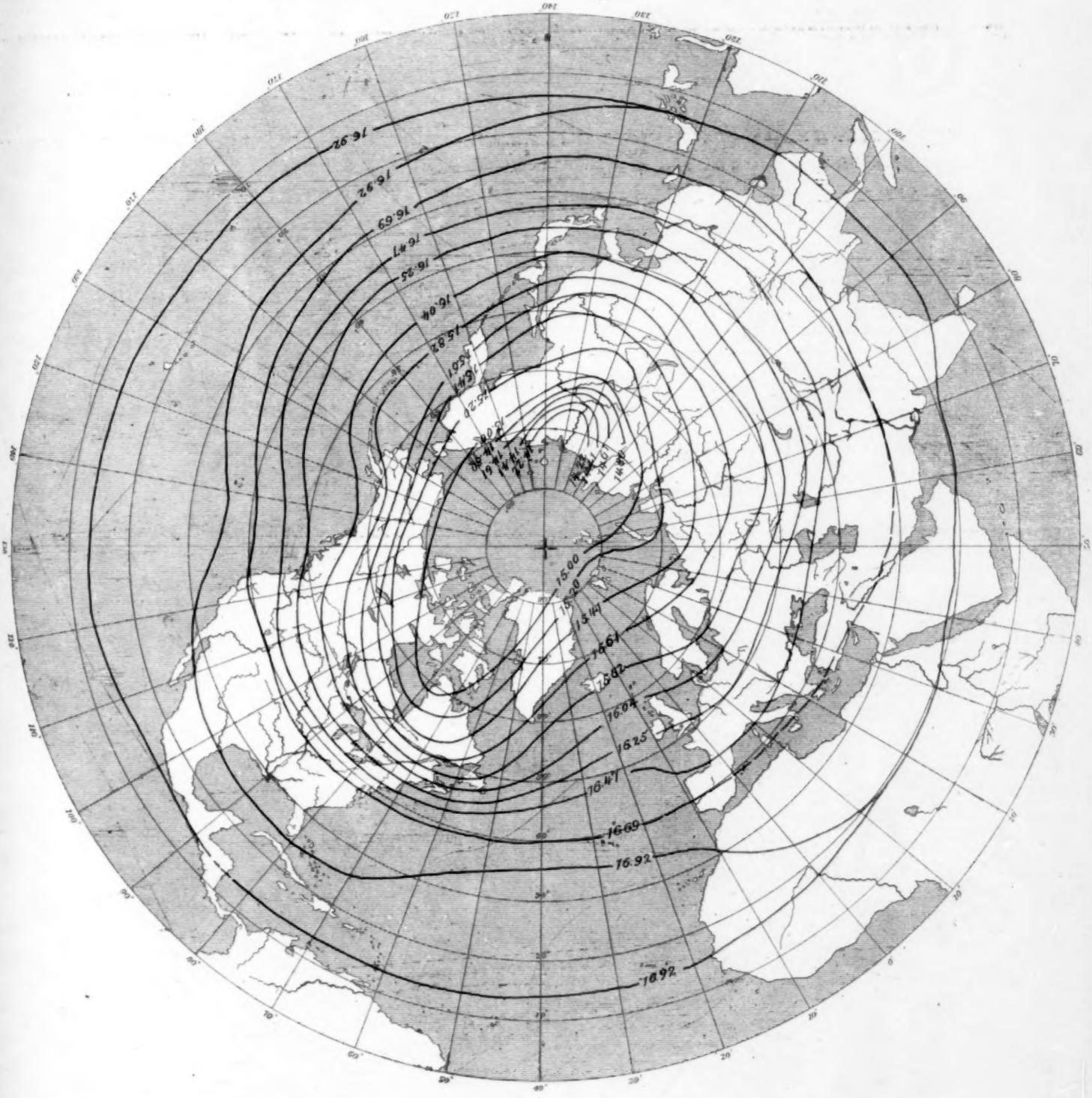
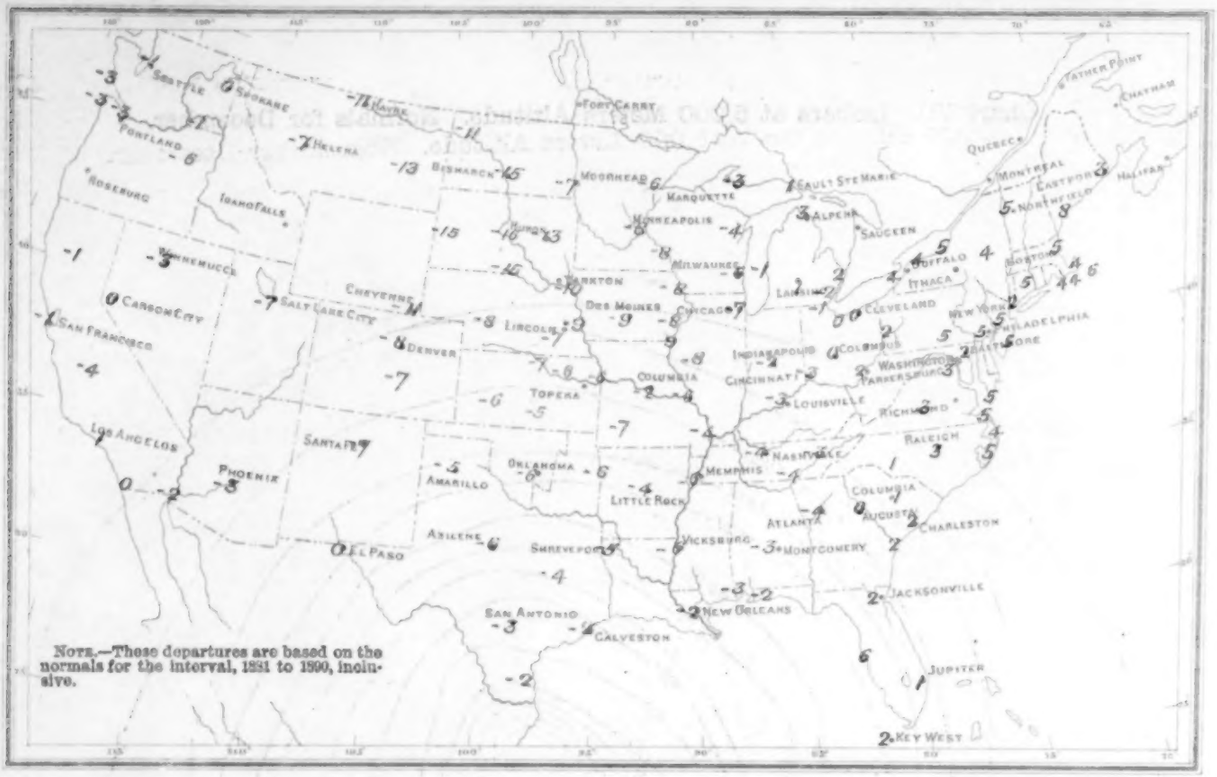
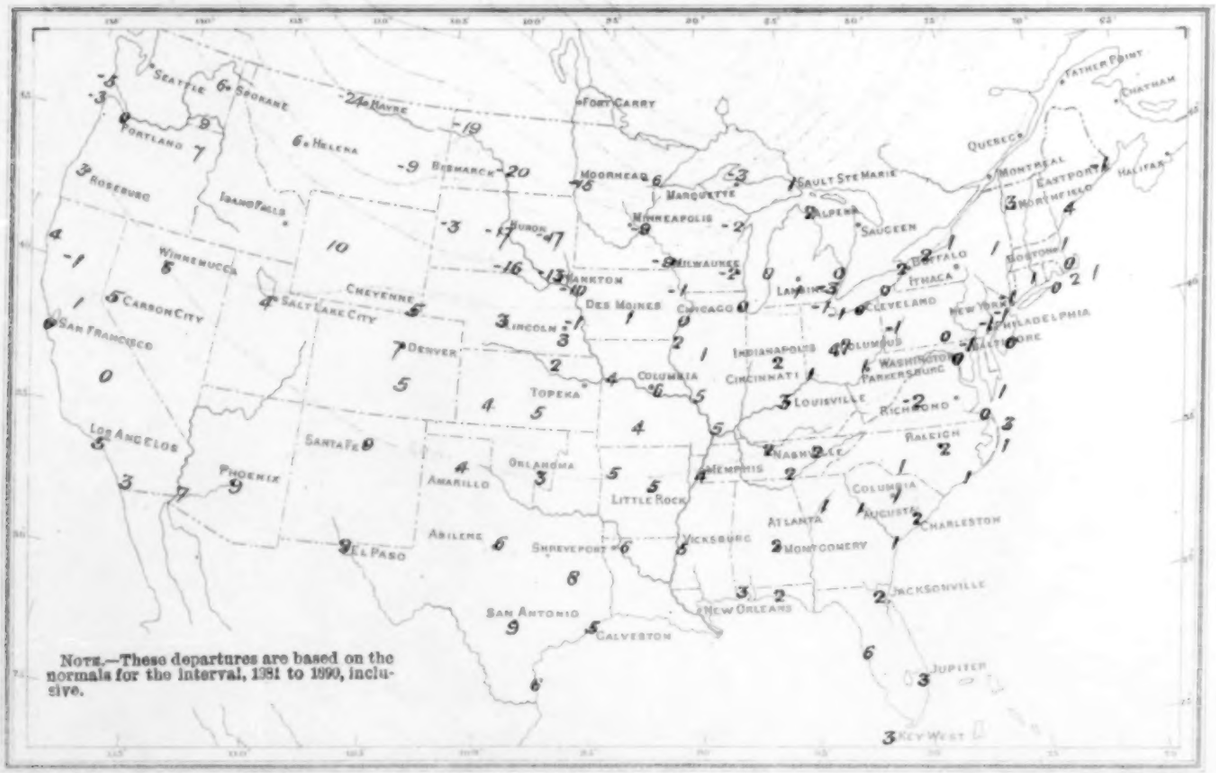


Chart VIII a. Temperature Departures, Week Ending November 9, 1896.



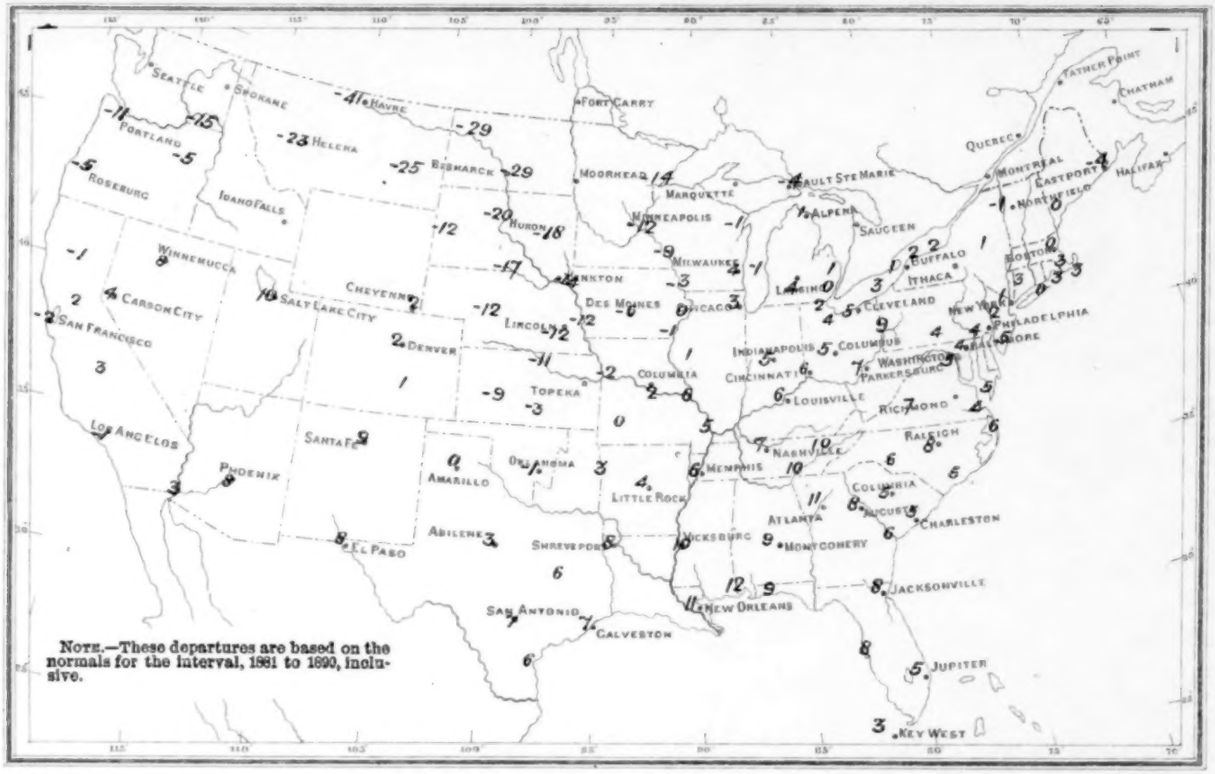
NOTE.—These departures are based on the normals for the interval, 1881 to 1890, inclusive.

Chart VIII b. Temperature Departures, Week Ending November 16, 1896.



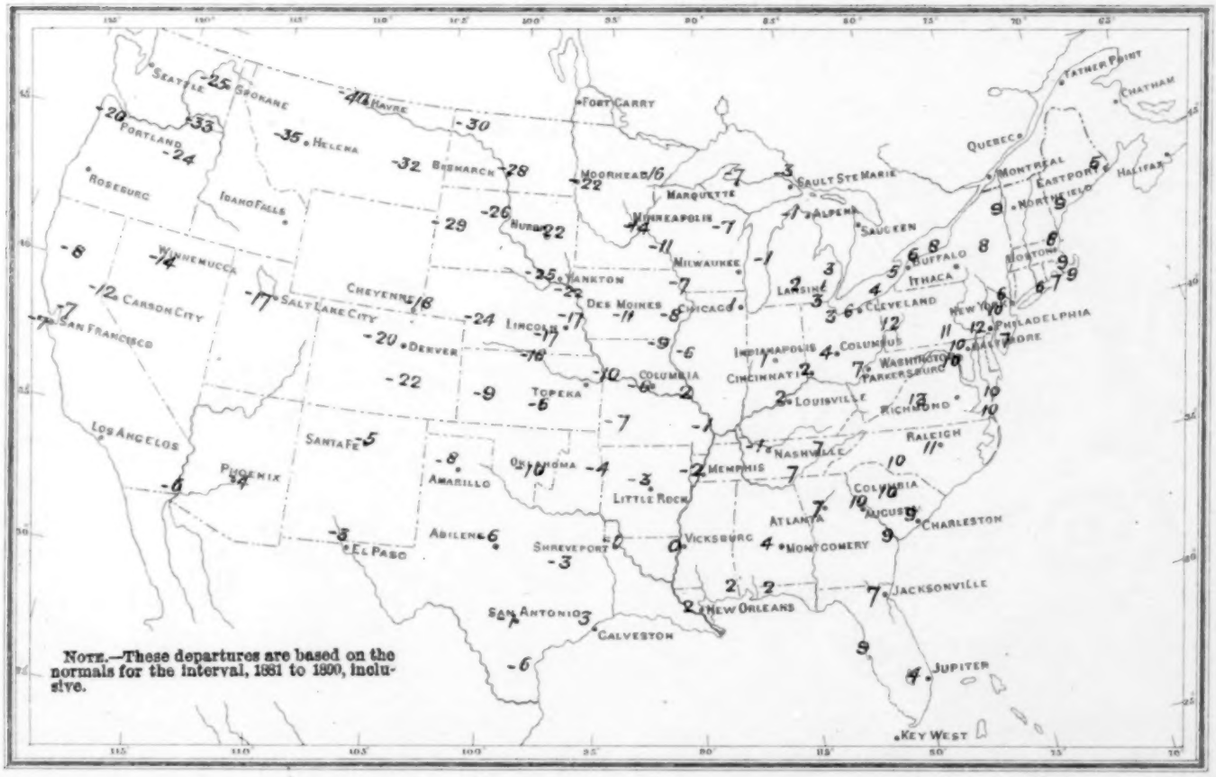
NOTE.—These departures are based on the normals for the interval, 1881 to 1890, inclusive.

Chart IX a. Temperature Departures, Week Ending November 23, 1896.



NOTE.—These departures are based on the normals for the interval, 1881 to 1890, inclusive.

Chart IX b. Temperature Departures, Week Ending November 30, 1896.



NOTE.—These departures are based on the normals for the interval, 1881 to 1890, inclusive.